Safety Evaluation Report

Related to the License Renewal of Beaver Valley Power Station, Units 1 and 2

Docket Nos. 50-334 and 50-412

FirstEnergy Nuclear Operating Company

United States Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

June 2009

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ABSTRACT

This safety evaluation report (SER) documents the technical review of the Beaver Valley Power Station (BVPS), Units 1 and 2, license renewal application (LRA) by the United States (US) Nuclear Regulatory Commission (NRC) staff (the staff). By letter dated August 27, 2007, 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 the Units 1 and 2, operating licenses (Facility Operating License Numbers DPR-66 and NPF-73, respectively) for a period of 20 years beyond the current expirations at midnight January 29, 2016, for Unit 1, and at midnight May 27, 2027, for Unit 2.

BVPS is located approximately 17 miles west of McCandless, PA. The NRC issued the construction permits for Unit 1 on June 26, 1970, and on May 3, 1974, for Unit 2. The NRC issued the operating licenses for Unit 1 on July 2, 1976, and on August 14, 1987, for Unit 2. Units 1 and 2 are of a dry subatmospheric pressurized water reactor design. Westinghouse Electric supplied the nuclear steam supply system and Stone and Webster originally designed and constructed the balance of the plant. The licensed power output of each unit is 2900 megawatt thermal with a gross electrical output of approximately 972 megawatt electric.

This SER presents the status of the staff's review of information submitted through June 04**,** 2009, the cutoff date for consideration in the SER. The staff identified an open item that must be resolved before any final determination on the LRA. SER Section 1.5 summarizes this item. Section 6.0 provides the staff's final conclusion on the review of the BVPS LRA.

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ABBREVIATIONS

AC	alternating current
ACI	American Concrete Institute
ACU	air conditioning unit
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Document Access and Management System
AEM	aging effect/mechanism
AERM	aging effect requiring management
AFW	auxiliary feedwater
AISC	American Institute of Steel Construction
AMP	aging management program
AMR	aging management review
AMSAC	ATWS Mitigation System Actuation Circuitry
ANSI	American National Standards Institute
ART	adjusted reference temperature
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
BTP	branch technical position
BVPS	Beaver Valley Power Station
BWR	boiling water reactor
CASS	cast austenitic stainless steel
CAT	chemical addition tank
CDF	core damage frequency
CE	electrical continuity
CF	chemistry factor
CFR	*Code of Federal Regulations*
CI	confirmatory item
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CO_2	carbon dioxide
CR-15	Unit 1 fuel cask crane
CR-27	Unit 1 moveable platform and hoists crane
CRDM	control rod drive mechanism
CREVS	control room emergency ventilation system
CRN201	Unit 2 polar crane
CRN215	Unit 2 spent fuel cask trolley
CRN227	Unit 2 moveable platform with hoists
CUF	cumulative usage factor
C_VUSE	Charpy upper shelf energy
DBA	design basis accident
DBE	design basis event
DC	direct current
DF	direct flow

DLCo	Duquesne Light Company
ECCS	emergency core cooling system
EDG	emergency diesel generator
EFPY	effective full-power year
El	elevation
EN	enclosure or protection
EOL	end-of-license (current license life)
EOLE	end-of-license-extended (end of renewed license life)
EPRI	Electric Power Research Institute
EQ	environmental qualification
ER	applicant’s environmental report
ERF	emergency response facility
ESF	engineered safety features
EXP	expansion or separation
FAC	flow-accelerated corrosion
FB	fire barrier
F_{en}	environmental fatigue life correction factor
FLB	flood barrier
FP	fire protection
FR	*Federal Register*
FSAR	final safety analysis report
ft-lb	foot-pound
FW	feedwater
GALL	Generic Aging Lessons Learned Report
GDC	general design criteria or general design criterion
GEIS	Generic Environmental Impact Statement
GL	generic letter
GSI	generic safety issue
HELB	high-energy line break
HHSI	high head safety injection
HLBS	HELB shielding
HS	heatsink
HVAC	heating, ventilation, and air conditioning
HX	heat exchanger
I&C	instrumentation and controls
IASCC	irradiation assisted stress corrosion cracking
IEB	inspection and enforcement bulletin
IEEE	Institute of Electrical and Electronics Engineers
IGA	intergranular attack
IGSCC	intergranular stress corrosion cracking
IN	information notice
INE	insulate (electrical)
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISG	interim staff guidance

ISI	inservice inspection
ksi	1000 pounds (kilo-pound) per square inch
kV	kilo-volt
LBB	leak-before-break
LER	licensee event report
LHSI	low head safety injection
LOCA	loss of coolant accident
LR	license renewal
LRA	license renewal application
LTOP	low-temperature overpressure protection
MB	missile barrier
MIC	microbiologically-influenced corrosion
MWe	megawatts-electric
MWt	megawatts-thermal
N_2	nitrogen
NA	not applicable
NaOH	sodium hydroxide
n/cm^2	neutrons per square centimeter
NDE	nondestructive examination
NDT	nil-ductility transition
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NRC	US Nuclear Regulatory Commission
NSSS	nuclear steam supply system
ODSCC	outside-diameter stress corrosion cracking
OI	open item
OPPS	overpressure protection system
pH	potential hydrogen
PMF	probable maximum flood
ppm	parts per million
PR	pressure relief
P-T	pressure-temperature
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PW	pipe whip restraint
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
QA	quality assurance
RAI	request for additional information
RCCA	rod cluster control assembly
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system

RG	regulatory guide
RHR	residual heat removal
RIS	regulatory issue summary
RP	gaseous relief path
rpm	revolutions per minute
RPV	reactor pressure vessel
RT	reference temperature
RT_{NDT}	reference temperature for nil ductility transition
ΔRT_{NDT}	shift in reference temperature for nil ductility transition
RT_{PTS}	reference temperature for pressurized thermal shock
RVI	reactor vessel internals
RWST	refueling water storage tank
SBO	station blackout
SC	structure and component
SCC	stress-corrosion cracking
SCW	shutdown cooling water
SER	safety evaluation report
SG	steam generator
SHD	shielding
SIS	safety injection system
SNS	support for Criterion (a)(2) equipment
SPB	structural pressure barrier
SOC	statement of consideration
SRE	support for Criterion (a)(3) equipment
SRP	Standard Review Plan
SRP-LR	Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants
SSC	system, structure, and component
SSE	safe-shutdown earthquake
SSR	support for Criterion (a)(1) equipment
t/4	one fourth of the way through the vessel wall
TLAA	time-limited aging analysis
TS	technical specifications
U_{60}	sixty year cumulative usage factor
U_{env}	cumulative usage factor which includes environmental effects
UFSAR	Updated Final Safety Analysis Report
USE	upper-shelf energy
UT	ultrasonic testing
UV	ultraviolet
VAC	volts alternating current
WANO	World Association of Nuclear Operators
WASS	wrought austenitic stainless steel
WCAP	Westinghouse Commercial Atomic Power
Zn	zinc

SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

This document is a safety evaluation report (SER) on the license renewal application (LRA) for Beaver Valley Power Station (BVPS), Units 1 and 2, as filed by the FirstEnergy Nuclear Operating Company (FENOC or the applicant). By letter dated August 27, 2007, FENOC submitted its application to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the BVPS operating licenses for an additional 20 years. The NRC staff (the staff) prepared this report to summarize the results of its safety review of the LRA for compliance with Title 10, 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 Kent Howard. Mr. Howard may be contacted by telephone at 301-415-2989 or by electronic mail at Kent.Howard@nrc.gov. Alternatively, written correspondence may be sent to the following address:

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

In its August 27, 2007, submission letter, the applicant requested renewal of the operating licenses issued under Section 104b (Operating License No. DPR-66) and Section 103 (Operating License No. NPF-73) of the Atomic Energy Act of 1954, as amended, for Units 1 and 2 for a period of 20 years beyond the current expirations at midnight January 29, 2016, for Unit 1, and at midnight May 27, 2027, for Unit 2. BVPS is located approximately 17 miles west of McCandless, PA. The NRC issued the construction permits for Unit 1 on June 26, 1970, and on May 3, 1974, for Unit 2. The NRC issued the operating licenses for Unit 1 on July 2, 1976, and on August 14, 1987, for Unit 2. Units 1 and 2 are of a dry subatmospheric pressurized water reactor design. Westinghouse Electric supplied the nuclear steam supply system and Stone and Webster originally designed and constructed the balance of the plant. The licensed power output of each unit is 2900 megawatt thermal with a gross electrical output of approximately 972 megawatt electric. The updated final safety analysis report (UFSAR) shows details of the plant and the site.

BVPS Units 1 and 2 are constructed of similar materials with similar environments. Therefore, the mechanical system and component information presented in the LRA typically applies to both units, and no unit-specific identifier is listed. However, design differences exist between Units 1 and 2. Those design differences are identified by using a designator (i.e., Unit 1 only or Unit 2 only). Further, BVPS assigned a different designator (i.e., common) for those cases in where the system, structure, or component (SSC) is used and/or shared by both units.

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 BVPS 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 04, 2009. The staff reviewed information received after that date depending on the stage of the safety review and the volume and complexity of the information. The public may view the LRA and all pertinent information and materials, including the UFSAR, at the NRC Public Document Room, located on the first floor of One White Flint North, 11555 Rockville Pike, Rockville, MD 20852-2738 (301-415-4737 / 800-397-4209), and at the Beaver Area Memorial Library, 100 College Avenue, Beaver, PA 15009-2704 or the Beaver County Library System, 1 Campus Drive, Monaca, PA 15061. In addition, the public may find the LRA, as well as materials related to the license renewal review, on the NRC Web site at http://www.nrc.gov.

This SER summarizes the results of the staff's safety review of the LRA and describes the technical details considered in evaluating the safety aspects of the units' proposed operation for an additional 20 years beyond the term of the current operating licenses. The staff reviewed the LRA in accordance with NRC regulations and the guidance in NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated September 2005.

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

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

In accordance with 10 CFR Part 51, the staff prepared a draft plant-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)." This supplement discusses the environmental considerations for license renewals for Units 1 and 2. The staff issued draft, plant-specific GEIS Supplement 36, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Beaver Valley Power Station Units 1 and 2, Draft Report for Comment," on September 19, 2008. The staff issued plant-specific GEIS Supplement 36, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Beaver Valley Power Station Units 1 and 2," on May 14, 2009.

1.2 License Renewal Background

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

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

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

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

1.2.1 Safety Review

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

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

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

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

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 perform an intended function without moving parts or without change in configuration or properties and are not subject to replacement based on a qualified life or specified time period. 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 SCs will be maintained consistent with the current licensing basis (CLB) for the period of extended operation. However, active equipment is considered to be adequately monitored and maintained by existing programs. In other words, detrimental aging effects that may affect active equipment can be readily identified and corrected through routine surveillance, performance monitoring, and maintenance. Surveillance and maintenance programs for active equipment, as well as other maintenance aspects of plant design and licensing basis, are required throughout the period of extended operation.

Pursuant to 10 CFR 54.21(d), the LRA is required to include a UFSAR supplement with a summary description of the applicant's programs and activities for managing 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 the LRA, the applicant fully utilized the process defined in NUREG-1801, Revision 1, "Generic Aging Lessons Learned (GALL) Report," dated September 2005. The GALL Report summarizes staff-approved aging management programs (AMPs) for many SCs subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources for the LRA review can be greatly reduced, improving the efficiency and effectiveness of the license renewal review process. The GALL Report summarizes the aging management evaluations, programs, and activities credited for managing aging for most of the SCs used throughout the industry. The report is also a quick reference for both applicants and staff reviewers to AMPs and activities that can manage aging adequately during the period of extended operation.

1.2.2 Environmental Review

Part 51 of 10 CFR contains regulations on environmental protection regulations. In December 1996, the staff revised the environmental protection regulations to facilitate the environmental review for license renewal. The staff prepared the GEIS to document its evaluation of possible environmental impacts associated with nuclear power plant license renewals. For certain types of environmental impacts, the GEIS contains generic findings that apply to all nuclear power plants and are codified in Appendix B, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," to Subpart A, "National Environmental Policy Act - Regulations Implementing Section 102(2)," of 10 CFR Part 51.

Pursuant to 10 CFR 51.53(c)(3)(i), a license renewal applicant may incorporate these generic findings in its environmental report. In accordance with 10 CFR 51.53(c)(3)(ii), an environmental report also must include analyses of environmental impacts that must be evaluated on a plant-specific basis (i.e., Category 2 issues).

In accordance with the National Environmental Policy Act of 1969, and 10 CFR Part 51, the staff reviewed the plant-specific environmental impacts of license renewal, including whether there was new and significant information not considered in the GEIS. As part of its scoping process, the staff held a public meeting on November 27, 2007, in Pittsburgh, Pennsylvania, to identify plant-specific environmental issues. The draft, plant-specific GEIS Supplement 36 documents the results of the environmental review and makes a preliminary recommendation as to the license renewal action. The staff held another public meeting on October 30, 2008, in Pittsburgh, Pennsylvania, to discuss draft, plant-specific GEIS Supplement 36. After considering comments on the draft, the staff published the final, plant-specific GEIS Supplement 36 separately from this report.

1.3 Principal Review Matters

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

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 has submitted the required information.

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

> The current Indemnity Agreement (No. B-73) for BVPS states in Article VII that the agreement shall terminate at the time of expiration of the license specified in Item 3 of the attachment to the agreement, which is the last to expire. Item 3 of the attachment to the indemnity agreement, as revised through Amendment No. 13 (effective December 16, 2005), lists BVPS Unit 1 and Unit 2 facility operating license numbers (DPR-66 and NPF-73, respectively). FirstEnergy Nuclear Operating Company has reviewed the original indemnity agreement and Amendments 1 through 13. Neither Article VII nor Item 3 of the attachment specify an expiration date for license numbers DPR-66 or NPF-73. Therefore, no changes to the indemnity agreement are deemed necessary as part of this application. Should the license numbers be changed by NRC upon issuance of the renewed licenses, 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 numbers upon issuance of the renewed licenses, if approved. Therefore, conforming changes to the indemnity agreement need not be made and the 10 CFR 54.19(b) requirements have been met.

Pursuant to 10 CFR 54.21, “Contents of Application - Technical Information,” the NRC requires that the LRA contain (a) an integrated plant assessment, (b) a description of any CLB changes during the staff’s review of the LRA, (c) an evaluation of TLAAs, and (d) an FSAR 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 three months before the scheduled completion of the staff’s review, the applicant submit an LRA amendment identifying any CLB changes to the facility that affect the contents of the LRA, including the UFSAR supplement. By letter dated October 24, 2008, the applicant submitted an LRA update which summarize the CLB changes that have occurred during the staff’s review of the LRA. This submission satisfies 10 CFR 54.21(b) requirements and is still under staff review.

Pursuant to 10 CFR 54.22, “Contents of Application - Technical Specifications,” the NRC requires that the LRA include changes or additions to the technical specifications (TSs) that are necessary to manage aging effects during the period of extended operation. In LRA Appendix D, the applicant stated that it had not identified any TS changes necessary for issuance of the renewed BVPS operating licenses. This statement adequately addresses the 10 CFR 54.22 requirement.

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

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

1.4 Interim Staff Guidance

License renewal is a living program. The staff, industry, and other interested stakeholders gain experience and develop lessons learned with each renewed license. The lessons learned address the staff’s performance goals of maintaining safety, improving effectiveness and efficiency, reducing regulatory burden, and increasing public confidence. Interim staff guidance (ISG) is documented for use by the staff, industry, and other interested stakeholders until incorporated into such license renewal guidance documents as the SRP-LR and GALL Report. Table 1.4-1 shows the current set of ISGs, as well as the SER sections in which the staff addresses them.

Table 1.4-1 Current Interim Staff Guidance

ISG Issue (Approved ISG Number)	Purpose	SER Section
Nickel-alloy components in the reactor coolant pressure boundary **(LR-ISG-19B)**	Cracking of nickel-alloy components in the reactor pressure boundary. ISG under development. NEI and EPRI-MRP will develop an augmented inspection program for GALL AMP XI.M11-B. This AMP will not be completed until the NRC approves an augmented inspection program for nickel-alloy base metal components and welds as proposed by EPRI-MRP.	**3.0.3.3.3**
Corrosion of drywell shell in Mark I containments **(LR-ISG-2006-01)**	To address concerns related to corrosion of drywell shell in Mark I containments.	**Not applicable to Beaver Valley Power Station, Units 1 and 2**

1.5 Summary of Open Items

As a result of its review of the LRA, including additional information submitted through June 04, 2009, the staff had identified the following open item (OI) in the draft SER with open item which was issued on January 9, 2009. An item is considered open if, in the staff's judgment, it does not meet all applicable regulatory requirements at the time of the issuance of the SER with open item. The staff had assigned a unique identifying number to each OI. As a result of the submittal of responses by the applicant for closure of the OI, the staff has reviewed those responses and found them to be acceptable for closure of the OI.

OI 3.0.3.1.11-1: (SER Section 3.0.3.1.11 – Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program)

In response to the staff RAI B.2.21-2, the applicant stated that plant-specific and industry operating experience will be used to identify areas for program improvement, including adjustment of the manhole inspection frequency. Therefore, plant inspection results and industry operating experience will be evaluated to determine if the manhole inspection frequency needs to be adjusted to ensure the cables are not exposed to significant moisture. The applicant further stated that as indicated by the corrective action to CR 04-03545, indication of water and cable submergence are visually evaluated by engineering using the corrective action program, and further action are taken based on the evaluation.

During the regional onsite inspection performed during the weeks of June 23, 2008 and July 14, 2008, the inspectors found water in the manholes that contain safety-related cables. The staff finds that these incidents demonstrated that the corrective actions described above, have not been properly implemented or were not adequate. In light of this operating experience, the staff is concerned that inaccessible medium-voltage cables that were submerged for a period of time may be degraded and may not perform their intended function during the period of extended operation. The applicant has not used operating experience to adjust manhole inspection frequency and/or using automatic means if frequent inspection fails to keep the cables dry.

In a letter dated September 8, 2008, the applicant stated that LRA Section B.2.21 requires replacement of the entire section, because the program is being changed from a new program consistent with NUREG-1801 to a new plant-specific program. FENOC has confirmed that all inaccessible medium-voltage cables within the scope of the new plant-specific program are suitable for operation in a submerged water environment. NUREG-1801 does not require inspection and testing of cables qualified for submerged (i.e., submarine cables). Therefore, no aging effect requiring management was identified for the BVPS cables. However, FENOC concluded that periodic inspection and testing of submerged medium-voltage cables was conservative to confirm that the aging effects are not occurring, and revised the program to be plant-specific.

By letters dated March 24, May 14, and May 20, 2009, the applicant amended LRA (Amendment Nos. 35, 36, and 37) Section B.2.21 and associated sections to be consistent with GALL AMP XI.E3. In addition, the applicant would implement the following license renewal commitments prior to entering the period of extended operation: (1) Adopting an acceptable methodology that demonstrates that the in-scope, continuously submerged, inaccessible, medium-voltage cables will continue to perform their intended function during the period of extended operation or, (2) implementing measures to minimize long term inaccessible medium voltage cable submergence or, (3) replacing in-scope continuous submerged inaccessible medium voltage cable with cables designed for submerged service. The staff finds that if the applicant implements Commitment 1 or 3, the aging effect and mechanism due to significant moisture will not be significant for medium voltage cables that are designed for these conditions. If the applicant implements Commitment 2, it will minimize cable exposure to significant moisture and thus minimize the potential for insulation degradation consistent with GALL AMP XI.E3. Consistency with GALL AMP XI.E3 and the applicant's license renewal commitments will ensure that submerged inaccessible medium-voltage cables will perform their intended functions consistent with the CLB during the period of extended operation. The staff concerns with OI 3.0.3.1.11-1 are resolved.

1.6 Summary of Proposed License Conditions

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

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

The second license condition requires future activities described in the UFSAR supplement to be completed prior to the period of extended operation with the exceptions as follows: For BVPS-1: UFSAR Supplement Commitments 20, 24, 29, and 31. For BVPS-2: UFSAR Supplement Commitments 22, 28, and 32.

The third license condition requires that all capsules in the reactor vessel that are removed and tested meet the requirements of American Society for Testing and Materials (ASTM) E 185-82 to the extent practicable for the configuration of the specimens in the capsule. Any changes to the capsule withdrawal schedule, including spare capsules, must be approved by the staff prior to implementation.

SECTION 2

STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 <u>Scoping and Screening Methodology</u>

2.1.1 Introduction

Title 10, Section 54.21 of the *Code of Federal Regulations* (10 CFR 54.21), “Contents of Application-Technical Information,” requires that each application for license renewal contain an integrated plant assessment (IPA). Furthermore, the IPA must list and identify those structures and components (SCs) that are subject to an aging management review (AMR) from all of the systems, structures, and components (SSCs) that are within the scope of license renewal in accordance with 10 CFR 54.4.

In license renewal application (LRA) Section 2.1, “Scoping and Screening Methodology,” the applicant described the methodology used to identify the SSCs at the Beaver Valley Power Station (BVPS) Units 1 and 2 that are within the scope of license renewal and the SCs subject to an AMR. The staff reviewed the FirstEnergy Nuclear Operating Company (FENOC or the applicant) scoping and screening methodology to determine whether it is consistent with the scoping requirements stated in 10 CFR 54.4 and the screening requirements stated in 10 CFR 54.21.

In developing the scoping and screening methodology for the LRA, the applicant considered the requirements of 10 CFR 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants” (the Rule), the statements of consideration related to the Rule, and the guidance provided in Nuclear Energy Institute (NEI) 95-10, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule,” Revision 6. Additionally, in developing this methodology, the applicant considered the correspondence between the U.S. Nuclear Regulatory Commission (NRC) and other applicants, and NEI.

2.1.2 Summary of Technical Information in the Application

In LRA Sections 2.0 and 3.0, the applicant provided the technical information required by 10 CFR 54.21(a). In LRA Section 2.1, the applicant described the process used to identify the SSCs that meet the license renewal scoping criteria pursuant to 10 CFR 54.4(a), and the process used to identify the SCs that are subject to an AMR, pursuant to 10 CFR 54.21(a)(1). The applicant provided the results of the process for identifying such SCs in the following LRA sections:

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

In LRA Section 3.0, “Aging Management Review Results,” the applicant provided aging management results in the following sections:

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

In LRA Section 4.0, “Time-Limited Aging Analysis,” the applicant provided an identification and evaluation of time-limited aging analyses.

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, Section 2.1, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants” (SRP-LR). The following NRC regulations form the basis for the acceptance criteria for the scoping and screening methodology review:

- 10 CFR 54.4(a), as it relates to identification of SSCs within the scope of the Rule.
- 10 CFR 54.4(b), as it relates to identification of the intended functions of SSCs determined to be within the scope of the Rule.
- 10 CFR 54.21(a)(1) and (a)(2), as they relate to methods used by the applicant to identify 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 LRA sections 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 BVPS facility, located in Shippingport, Pennsylvania, during the week of December 3-6, 2007. The audit focused on ensuring that the applicant had developed and implemented adequate guidance to conduct the scoping and screening of SSCs in accordance with the methodologies described in the LRA and the requirements of the Rule. The staff reviewed implementation of the project level guidelines and topical reports describing the applicant’s scoping and screening methodology. In addition, the staff conducted detailed discussions with the applicant on the implementation and control of the license renewal program and reviewed administrative control documentation and selected design documentation used by the applicant during the scoping and screening process. The staff also reviewed training for personnel that developed the LRA, and quality practices used by the applicant to develop the LRA. Additionally, the staff evaluated the quality attributes of the applicant's aging management program (AMP) activities described in LRA Appendix A, "Updated Final Safety Analysis Report Supplement" and Appendix B, "Aging Management Programs and Activities." The staff also reviewed the training and qualification of the LRA development team. In addition, the staff reviewed scoping and screening results reports for the main steam system (MSS), residual heat removal (RHR), the turbine building (TB), and the main intake structure to ensure that the applicant had appropriately implemented the methodology outlined in the administrative controls and that the results were 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 implementation procedures as documented in the Scoping and Screening Methodology Audit report, dated March 17, 2008, to verify that the process used to identify SCs subject to an AMR, was consistent with the LRA and SRP-LR. Additionally, the staff reviewed the scope of CLB documentation sources and the process used by the applicant to ensure that CLB commitments were appropriately considered and that the applicant had adequately implemented the 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 stated that it reviewed the following information sources during the license renewal scoping and screening process:

- Updated Final Safety Analysis Report (UFSAR)
- BVPS Safety Evaluation Reports (SERs)
- BVPS docketed information sources
- Maintenance Rule Database and Maintenance Rule Basis Documents
- Design-Basis Document (DBD) Source Documents – DBDs were not cited as references, but were used to identify other controlled references
- Plant Engineering Drawings – site plan drawing, plant general arrangement drawings, valve operating number diagrams, piping and instrumentation diagrams (P&IDs), flow diagrams, controlled vendor drawings, isometric drawings, civil drawings
- Piping calculations
- Plant Operating Manuals and Procedures
- Emergency Operating Procedures and background documents

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

2.1.3.1.2 Staff Evaluation

Scoping and Screening Implementation Procedures. The staff reviewed the applicant's scoping and screening methodology implementation procedures, including license renewal guidelines, documents, reports, and AMR reports, as documented in the audit report, to ensure the guidance was consistent with the requirements of the rule, SRP-LR and NEI 95-10. The staff found the overall process used to implement the 10 CFR 54 requirements described in the implementing documents and AMRs was consistent with the rule and industry guidance. Guidance for determining plant SSCs within the scope of the Rule, and for determining which SCs, within the scope of license renewal, were subject to an AMR, were contained in the applicant's implementing documents.

During the review of the implementing documents, the staff focused on the consistency of the detailed procedural guidance with information in the LRA, including the implementation of staff guidance documented in SRP-LR, and the information in request for additional information (RAI) responses dated April 3, 2008.

After reviewing the LRA and supporting documentation, the staff found that the scoping and screening methodology instructions were consistent with LRA Section 2.1. The applicant's methodology contained sufficient detail to provide concise guidance on the scoping and screening implementation process 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 was sufficiently comprehensive to identify SSCs within the scope of license renewal, as well as component types requiring an AMR. As defined in 10 CFR 54.3(a), the CLB is the set of staff requirements applicable to a specific plant and a licensee's written commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design bases that are docketed and in effect. The CLB includes certain NRC regulations, orders, license conditions, exemptions, Technical Specifications, design-basis information documented in the most recent UFSAR, and licensee commitments remaining in effect that were made in docketed licensing correspondence such as licensee responses to NRC bulletins, generic letters, and enforcement actions, as well as licensee commitments documented in staff safety evaluations or licensee event reports.

During the audit, the staff reviewed pertinent information sources utilized by the applicant that included the UFSAR, license renewal boundary diagrams, and maintenance rule information. In addition, the applicant's license renewal process identified additional potential sources of plant information pertinent to the scoping and screening process, including, SERs, docketed information sources, DBD source documents, plant engineering drawings, piping calculations, plant operating manuals and procedures, emergency operating procedures, and background documents. The staff verified that the applicant's detailed license renewal program guidelines required use of the CLB source information in developing scoping evaluations.

The BVPS equipment database, the UFSAR and maintenance rule information were the applicant's primary repository for system identification and classification information. During the audit, the staff reviewed the applicant's administrative controls for the equipment database, maintenance rule information and other information sources used to verify system information.

These controls are described and implementation is governed by plant administrative procedures. Based on a review of the administrative controls, and a sample of the system identification and classification information contained in the applicable BVPS documentation, the staff concluded that the applicant had established adequate measures to control the integrity and reliability of system identification and classification data; and, therefore, 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 provided the staff with a discussion regarding 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 provided a description of the CLB and related documents used during the scoping and screening process that is consistent with the guidance contained in SRP-LR. In addition, the staff reviewed the implementing procedures and results reports used to support identification of SSCs relied upon to demonstrate compliance with the safety-related criteria, nonsafety-related criteria and regulated events criteria pursuant to 10 CFR 54.4(a). The applicant's license renewal program guidelines provided a comprehensive listing of documents used to support scoping and screening evaluations. The staff found 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 information provided in LRA Section 2.1, a review of the applicant's detailed scoping and screening implementation procedures, and the results from the scoping and screening audit, the staff concludes that the applicant's scoping and screening methodology considered CLB information consistent with the guidance of the SRP-LR and the requirements of 10 CFR Part 54; and, therefore is acceptable.

2.1.3.2 Quality Assurance Controls Applied to LRA Development

2.1.3.2.1 Staff Evaluation

During the onsite scoping and screening methodology audit, the staff reviewed the quality controls used by the applicant to ensure that scoping and screening methodologies documented in the LRA were adequately implemented. The staff determined that the applicant applied the following quality assurance (QA) processes during the LRA development:

- The scoping and screening methodology was governed by written procedures, guidelines, and project checklist packages
- The LRA was examined and approved by the applicant's license renewal oversight board, license renewal assessment board, and plant review board
- The applicant implemented a four-step document development process to prepare, check, review, and approve each license renewal document
- The applicant's QA organization performed two self-assessments of the implementation of LRA

The staff reviewed implementing procedures, guidance documents, and selected portions of results reports and self assessment documentation and determined that the applicant had established and implemented a program to ensure adequate quality of the LRA.

2.1.3.2.2 Conclusion

Based on its review of reports and LRA development implementing procedures and guidance, and a discussion with the applicant's license renewal personnel, the staff concludes that the QA activities have met current regulatory requirements and have provided assurance that LRA development activities were performed consistent with the applicant's LRA program requirements.

2.1.3.3 Training

2.1.3.3.1 Staff Evaluation

During the scoping and screening methodology audit, 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. The applicant required training for all personnel participating in the LRA development, including both contract personnel and the applicant's staff, and used only trained personnel to prepare the scoping and screening implementing procedures. Prior to participating in the scoping and screening activities, the applicant required that its personnel complete a qualification program.

The training consisted of a combination of reading, computer-based training, attending training sessions, and a discussion with the project lead. These training requirements were documented on a qualification card. All license renewal personnel were required to review applicable license renewal and 10 CFR Part 50 regulations, NEI 95-10, Regulatory Guide (RG) 1.188, SRP-LR, and NUREG-1801, "Generic Aging Lessons Learned" (GALL) Report. In addition, all license renewal personnel were required to read license renewal project documents which included a project plan, project schedule, and business documents.

The audit team reviewed completed qualification and training records of several of the applicant's license renewal personnel responsible for the LRA development and determined that the records documented adequate training of the applicant's staff. Additionally, based on discussions with the applicant's license renewal personnel during the audit, the audit team determined that the personnel were knowledgeable on specific technical issues and the requirements associated with LRA development.

2.1.3.3.2 Conclusion

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

2.1.3.4 Conclusion of Scoping and Screening Program Review

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

2.1.4 Plant Systems, Structures, and Components Scoping Methodology

In LRA Section 2.1.1, the applicant described the methodology used to scope SSCs pursuant to the requirements of the 10 CFR 54.4(a). The applicant described the scoping process for the plant in terms of systems and structures. Specifically, the scoping process consisted of developing a list of plant systems and structures, identifying their intended functions, and determining which functions meet one or more of the criteria of 10 CFR 54.4(a).

The systems list was developed using the equipment database and maintenance rule system information. Information on mechanical systems and structural intended functions was obtained from the UFSAR, maintenance rule information and additional CLB information. All electrical and instrument and control (I&C) systems, and electrical and I&C components in mechanical systems, were included within the scope of license renewal. The identified systems and structures and their associated functions were evaluated against the criteria of 10 CFR 54.4 as described in SER Sections 2.1.4.1 through 2.1.4.3.

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

2.1.4.1.1 Summary of Technical Information in the Application

In LRA Section 2.1.1.1, the applicant described the scoping methodology as it relates to the safety-related criterion pursuant to 10 CFR 54.4(a)(1). With respect to the safety-related criterion, the applicant stated that the safety-related systems and structures are initially identified based on a review of the BVPS equipment database. Systems and structures which contained a component which was classified as safety-related were included within the scope of license renewal. The LRA stated that all plant conditions, including conditions of normal operation, design-basis accidents (DBAs), external events, and natural phenomena for which the plant must be designed, were considered for license renewal scoping pursuant to 10 CFR 54.4(a)(1) criteria.

2.1.4.1.2 Staff Evaluation

Pursuant to 10 CFR 54.4(a)(1), the applicant must consider all safety-related SSCs relied upon to remain functional during and following a design-basis event (DBE) to ensure (a) the integrity of the reactor coolant pressure boundary, (b) the capability to shut down the reactor and maintain it in a safe-shutdown condition, or (c) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to those pursuant to 10 CFR 50.34(a)(1), 50.67(b)(2), or 100.11.
With regard to identification of DBEs, SRP-LR Section 2.1.3 states:

> The set of DBEs as defined in the Rule is not limited to Chapter 15 (or equivalent) of the FSAR. 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 FSAR, 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) are maintained.

During the audit, the applicant stated that it had evaluated the types of events listed in NEI 95-10 (i.e., anticipated operational occurrences, DBAs, external events and natural phenomena) applicable to BVPS and identified the documents that described those events. The UFSAR and system DBDs for Units 1 and 2, discusses events such as internal and external flooding tornados, and missiles. The applicant also reviewed licensing correspondence and design criteria.

The staff confirmed that all plant conditions, including conditions of normal operation, DBAs, external events, and natural phenomena for which the plant must be designed, were considered for license renewal scoping in accordance with 10 CFR 54.4(a)(1) criteria and concludes that the applicant's evaluation of DBEs was consistent with SRP-LR.

The applicant performed scoping of SSCs in accordance with 10 CFR 54.4(a)(1) criteria. The applicant's license renewal implementing documents provided guidance for the preparation, review, verification, and approval of the scoping evaluations to assure the adequacy of the results of the scoping process. The staff reviewed the implementing documents governing the applicant's evaluation of safety-related SSCs, and sampled the applicant's scoping results reports to ensure the methodology was implemented in accordance with those written instructions. In addition, the staff discussed the methodology and results with the applicant's personnel who were responsible for these evaluations.

During the audit, the staff noted that the applicant's definitions of safety-related used to identify SSCs within the scope of license renewal in the LRA, the license renewal scoping procedures, and the text of the plant classification document, agree with the definition pursuant to 10 CFR 54.4(a)(1)(iii). However, the form or procedure used to initially populate the equipment database, and subsequently relied upon to identify safety-related SSCs, referred only to 10 CFR Part 100. Units 1 and 2 have been approved by the staff for use of the alternate source term and; therefore, 10 CFR 50.67(b)(2) is applicable. The staff determined that additional information would be required to complete the review of the applicant's scoping methodology.

In RAI 2.1-1, dated March 5, 2008, the staff requested that the applicant provide a written evaluation that addresses the impact, if any, of the use of differing definitions of safety-related.

In its response to RAI 2.1-1, dated April 3, 2008, the applicant stated:

> There was no impact on license renewal scoping due to the worksheet error regarding the definition of "safety-related." FENOC explicitly considered those systems, structures, or components (SSCs) that are relied upon to ensure, "...the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guidelines in 10 CFR 50.34(a)(1),10 CFR 50.67(b)(2), or 10 CFR 100.11 of this chapter, as applicable," consistent with the current licensing basis.

> The Quality Class Determination Worksheet reference to 10 CFR 100 alone, instead of including 10 CFR 50.67 and 10 CFR 50.34, was an error. This conclusion is based upon the fact that the Alternate Source Term (AST) methodology and inputs for determining post-design bases accident (DBA) radiological doses under 10 CFR 50.67 were incorporated into the BVPS licensing bases as a result of the BVPS Unit 1 and 2 License Amendments. The Unit 1 and 2 Waste Gas System Ruptures, however, are still assessed under the provisions of 10 CFR 100.11; thus, the Quality Class Determination Worksheets should refer to both dose criteria, as applicable. The Quality Class Determination Worksheet was revised to correct the error. The parent procedure that provides detailed steps for performing a safety classification using the Quality Class Determination Worksheet included the correct reference to,…" 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11, as applicable."

Based on its review, the staff finds the applicant's response to RAI 2.1-1 acceptable because the applicant has provided a description of an adequate process used so that SSCs have been appropriately included within the scope of license renewal, pursuant to 10 CFR 54.4(a)(1) and that the definitions for safety-related used to classify SSCs, were consistent with the requirements of 10 CFR 54.4(a)(1). Therefore, the staff's concern described in RAI 2.1-1 is resolved.

During the audit, the staff noted that the applicant identified certain components for Units 1 and 2 that were classified as "Q" (a BVPS term used to identify safety-related components), and which are located within the nonsafety-related TB. However, the identified "Q" components were not included within the scope of license renewal as required by 10 CFR 54.4(a)(1). In addition, neither the TB nor the nonsafety-related SSCs in the vicinity of the "Q" components were included within the scope of license renewal as required by 10 CFR 54.4(a)(1) or (a)(2), as applicable.

In RAI 2.1-4, dated March 5, 2008, the staff requested that the applicant provide a written evaluation that addresses its review of this issue.

In the response to RAI 2.1-4, dated April 3, 2008, the applicant stated:

> Certain instrumentation located in the Unit 1 and 2 turbine buildings, and the Unit 2 component supports associated with the instrumentation, is conservatively assigned the classification of "Q" in the plant equipment database, but is not relied upon to remain functional during or following design basis events (the classification "Q" is assigned to all safety-related equipment at BVPS). All instrumentation in this category is within the scope of license renewal, but is screened out as active electrical components, and is not subject to aging management review. The LRA did not provide the level of detail to confirm that the specific component supports associated with the Unit 2 "Q" instrumentation piping are within the scope of license renewal. However, the Unit 2 Turbine Building civil AMR did not exclude or limit the scope of component supports. Therefore, all components in the Turbine Buildings with a "Q" designation in the plant equipment database are within the scope of license renewal.
>
> Circuit failure analyses were performed and concluded that any faults associated with instrumentation in the turbine buildings that is classified "Q" in the plant

> equipment database would not result in a loss of any safety-related function. The faults considered were grounds, conductor shorts, open circuits, hot shorts with other cables in the same raceway or enclosure, and high impedance faults. Therefore, while these instruments and supports are assigned a quality classification "Q" in the plant equipment database, the classification is conservative, and these components do not perform a 10 CFR 54.4(a)(1) function, as documented within the BVPS CLB. Since the "Q" instruments can fail in any of the ways stated above without loss of safety function, and do not perform a 10 CFR 54.4(a)(1) function, failures of nearby nonsafety-related components cannot interact with these components in any way to result in a loss of a safety function. The evaluations also apply to the Unit 2 instrument supports, which are also classified "Q," since the failure of any supports would not result in any new failure modes for the instrumentation. Nonsafety-related components in the vicinity that interact with the instrumentation supports cannot result in loss of a safety-related function. Relative to the "Q" instrumentation and instrumentation supports in the turbine buildings, the license renewal scoping methodology used at BVPS did not preclude identification of safety-related SSCs which should have been included within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.1-4 acceptable because the applicant has provided a description of an adequate process which determined that components located within the TB have been conservatively classified as "Q" (which the applicant used to designate safety-related SSCs), although they do not perform an intended function, which would require that they be included within the scope of license renewal pursuant to 10 CFR 54.4(a)(1). The applicant stated that it had determined that, based on information contained in the CLB for BVPS, the "Q" components located in the TB do not perform an intended function. The staff further finds that since the "Q" components located in the TB do not perform an intended function, the applicant is not required to evaluate other nonsafety-related components for interactions, in accordance with 10 CFR 54.4(a)(2). Therefore, the staff's concern described in RAI 2.1-4 is resolved.

The staff reviewed a sample of the license renewal scoping results for the MSS, RHR, TB, and main intake structure to provide additional assurance that the applicant adequately implemented their scoping methodology in accordance with 10 CFR 54.4(a)(1). The staff verified that the scoping results for each of the sampled systems were developed consistent with the methodology, the SSCs credited for performing intended functions were identified, and the basis for the results as well as the intended functions were adequately described. The staff verified that the applicant has identified and used pertinent engineering and licensing information to identify the SSCs required to be within the scope of license renewal as required by 10 CFR 54.4(a)(1).

2.1.4.1.3 Conclusion

Based on its review of sample systems, discussions with the applicant, review of the applicant's scoping process, and the applicant's responses to RAIs 2.1-1 and 2.1-4, the staff concludes that the applicant's methodology for identifying systems and structures is consistent with SRP-LR and 10 CFR 54.4(a)(1); and, therefore is acceptable.

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

2.1.4.2.1 Summary of Technical Information in the Application

In LRA Section 2.1.1.2, the applicant described the scoping methodology as it relates to the nonsafety-related criteria pursuant to 10 CFR 54.4(a)(2). Also, the applicant's 10 CFR 54.4(a)(2) scoping methodology was based on guidance provided in NEI 95-10, Revision 6, Appendix F. The applicant evaluated the impacts of nonsafety-related SSCs that met 10 CFR 54.4(a)(2) criteria by considering both functional and physical failures.

Functional Failure of Nonsafety-Related SSCs. In LRA Section 2.1.1.2.1, the applicant stated that SSCs required to perform a function in support of safety-related components are generally classified as safety-related and are included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). For the few exceptions where nonsafety-related systems and structures are required to remain functional to support a safety function, the systems and structures were included within the scope of license renewal pursuant to 10 CFR 54.4(a)(2).

Nonsafety-Related SSCs directly connected to Safety-Related SSCs. In LRA Section 2.1.1.2.2, the applicant stated that nonsafety-related piping and supports are within the scope of license renewal, up to and including the seismic anchor, as identified in the stress analysis and an equivalent anchor or one of the other bounding conditions, pursuant to the guidance found in NEI 95-10, Appendix F (*i.e.*, base mounted component, flexible connection, or to include the entire piping run). The LRA defined a seismic anchor or equivalent anchor as a seismic anchor or group of supports that provide lateral and torsional support in three orthogonal directions. The other methods used to define a scoping boundary include (a) the limits of a piping stress calculation, (b) the limits of evaluations described in Inspection and Enforcement Bulletin (IEB) 79-14, "Seismic Analyses for As-built Safety-Related Piping Systems," as shown on isometric or other controlled engineering drawings, and (c) approved design engineering evaluation and acceptance of an endpoint for scoping, documenting that piping beyond the scoping endpoint is not required for support of the safety-related piping components.

Nonsafety-Related SSCs With the Potential for Spatial Interaction With Safety-Related SSCs. In LRA 2.1.1.2.3, the applicant stated that nonsafety-related systems and nonsafety-related portions of safety-related systems are identified as within the scope of license renewal pursuant to 10 CFR 54.4(a)(2), if there is a potential for spatial interactions with safety-related equipment. Spatial failures are defined as failures of nonsafety-related SSCs located in the vicinity of safety-related SSCs that create the potential for interaction between the SSCs due to physical impact, pipe whip, jet impingement, a harsh environment resulting from a piping rupture, or damage due to leakage or spray and; thus, could impede or prevent the accomplishment of the safety-related functions of a safety-related SSC. Mitigative features, such as missile barriers, flood barriers, and spray shields, were included within the scope of license renewal pursuant to 10 CFR 54.4(a)(2). In addition, the preventive option described in NEI 95-10, Appendix F, was used to determine the scope of license renewal with respect to the protection of safety-related SSCs from spatial interactions not addressed in the CLB. This scoping process required an evaluation based on equipment location and the related SSCs and whether fluid-filled system components are located in the same space as safety-related equipment. For the purposes of the review, a "space" was defined as a structure containing safety-related SSCs.

2.1.4.2.2 Staff Evaluation

Pursuant to 10 CFR 54.4(a)(2), the applicant must consider all nonsafety-related SSCs, whose failure could prevent satisfactory accomplishment of safety-related function, for SSCs relied upon to remain functional during and following a DBE to ensure the following functions: (a) the integrity of the reactor coolant pressure boundary; (b) the capability to shut down the reactor and maintain it in a safe-shutdown condition; or (c) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to those pursuant to 10 CFR 50.34(a)(1), 50.67(b)(2), or 100.11.

RG 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," Revision 1, provides staff endorsement on the use of NEI 95-10, Revision 6, Appendix F. RG 1.188 provides the staff position on 10 CFR 54.4(a)(2) scoping criteria; nonsafety-related SSCs typically identified in the CLB; consideration of missiles, cranes, flooding; high-energy line breaks (HELBs); nonsafety-related SSCs connected to safety-related SSCs, nonsafety-related SSCs in proximity of safety-related SSCs; and the mitigative and preventative options related to nonsafety-related and safety-related SSCs interactions.

In addition, the staff position states that applicants should not consider hypothetical failures, but rather, should base their evaluation on the plant's CLB, engineering judgment and analyses, and relevant operating experience. NEI 95-10 further describes operating experience as all documented plant-specific and industry-wide experience that can be used to determine the plausibility of a failure. Documentation would include NRC generic communications and event reports, plant-specific condition reports, industry reports such as safety operational event reports, and engineering evaluations.

The staff reviewed LRA Section 2.1.2.2, where the applicant described its scoping methodology pursuant to 10 CFR 54.4(a)(2) nonsafety-related criteria. In addition, the staff reviewed the applicant's results report which documented the guidance and corresponding results of the 10 CFR 54.4(a)(2) scoping review requirement, which the applicant had performed pursuant to the guidance in NEI 95-10, Revision 6, Appendix F.

Nonsafety-Related SSCs Required to Perform a Function that Supports a Safety-Related SSC. The staff determined that nonsafety-related SSCs required to remain functional to support a safety-related function were included as safety-related within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) with several exceptions, which were included within the scope of license renewal pursuant to 10 CFR 54.4(a)(2). This evaluating criteria was discussed in the applicant's 10 CFR 54.4(a)(2) report. The staff found that the applicant had implemented an acceptable method for scoping of nonsafety-related systems that perform a function that supports a safety-related intended function.

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

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 be included within the scope of license renewal:

- Seismic anchors
- Equivalent anchors
- Limits of the piping stress calculation
- Bounding conditions described in NEI 95-10, Appendix F (base mounted component, flexible connection, or to include the entire piping run)
- The limits of IEB 79-14, "Seismic Analyses for As-built Safety-Related Piping Systems," evaluations as shown on isometric or other controlled engineering drawings
- Approved design engineering evaluation and acceptance of an endpoint for scoping that provides documentation that piping beyond the scoping endpoint is not required for support of the safety-related piping components

During the audit, the staff noted that the applicant indicated that equivalent anchors had been used to identify portions of nonsafety-related pipe to be included within the scope of license renewal. However, the applicant stated that in certain cases, combinations of less than two restraints or supports in each of the three orthogonal directions had been used as equivalent anchors to determine the portions of nonsafety-related pipe, attached to safety-related SSCs, as included within the scope of license renewal. The staff determined that additional information was required to complete its review of the applicant's scoping methodology.

In RAI 2.1-2, dated March 5, 2008, the staff requested that the applicant provide a written evaluation that addresses its review of this issue.

In its response to RAI 2.1-2, dated April 3, 2008, the applicant stated:

> A review was conducted of the evaluations for nonsafety-related piping directly attached to safety-related piping for which groups of supports were used to define an endpoint for license renewal scoping. This review identified some additional nonsafety-related components that were added to scope to ensure that each such combination of supports included at least two supports in each of three orthogonal directions (or the scoping terminated at another alternative specifically identified by NEI 95-10, Appendix F, such as a base mounted component). Scoping for the boundaries of nonsafety-related piping components that are directly connected to safety-related components relied upon engineering evaluations of combinations of supports for a total of forty-eight safety to nonsafety transitions. Those engineering evaluations provided conclusions that the piping beyond the scoping boundary was not required to provide support to the attached safety-related components, but did not identify whether the evaluation specifically verified two supports in each of three orthogonal directions. The piping configuration for each of the forty-eight safety to nonsafety transitions that relied upon a group of supports was re-evaluated in response to this question. The existing evaluations for thirty-three transitions were confirmed to encompass at least two supports in each of three orthogonal directions. The remaining fifteen transitions required additions to the depictions of the scoping boundary shown on the applicable license renewal boundary drawings. In two

cases, the scoping boundary was expanded to include components that resulted in a clarifying change to an AMR, but the changes did not result in a new combination of component, material, environment, aging effect, so the AMR results did not change.

Based on its review, the staff finds the applicant's response to RAI 2.1-2 acceptable because the applicant has provided a description of an adequately modified process used to ensure that SSCs have been appropriately included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The staff also finds that as a result of the modified process, the applicant has included additional SSCs within the scope of license renewal. Therefore, the staff's concern described in RAI 2.1-2 is resolved.

In LRA Section 2.1.1.2.2, the applicant stated that the limits of IEB 79-14, "Seismic Analyses for As-built Safety-Related Piping Systems," evaluations as shown on isometric or other controlled engineering drawings, were used to identify the portions of nonsafety-related piping, attached to safety-related SSCs, included within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2).

In RAI 2.1-3, dated March 5, 2008, the staff requested that the applicant provide a discussion to address how the information obtained in the walk-downs, previously performed in support of IEB 79-14, was used to identify either a seismic anchor or an equivalent anchor, as defined in NEI 95-10, Revision 6, Appendix F, to determine the portion of the nonsafety-related pipe included within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2).

In its response to RAI 2.1-3, dated April 3, 2008, the applicant stated the following:

> IEB 79-14 requested utilities to verify that their seismic analyses applied to the actual configuration of safety-related piping systems. The specific text of IEB 79-14 states, in part: "All power reactor facility licensees and construction permit holders are requested to verify, unless verified to an equivalent degree within the last 12 months, that the seismic analysis applies to the actual configuration of safety-related piping systems." The actions taken at Unit 2 to ensure the validity of seismic analysis were incorporated into the design and construction effort, and no notations related to IEB 79-14 appear on the Unit 2 piping or isometric drawings.
>
> License renewal scoping related to the use of IEB 79-14 notations on isometric piping drawings at BVPS is limited to Unit 1.
>
> As part of the response to IEB 79-14 for BVPS Unit 1, the architectural engineer generated detailed formal stress analyses for the safety-related piping systems. The calculations revised for IEB 79-14 remain, for the most part, the analytical basis for BVPS Unit 1 safety-related piping. Subsequent modifications to the piping have been qualified in revisions to these same calculations.
>
> As dictated by IEB 79-14, field walkdowns were performed on the piping required to complete the analyses. The site procedures that controlled the piping analyses and walkdowns specified inclusion of piping in the analyses and walkdowns up to

an equivalent translational anchor, or to branch piping that is significantly less stiff and less massive than the pipe being analyzed. The equivalent translational anchor is defined in the site procedures as a "hanger or combination of hangers which restrains the piping in 3 orthogonal directions." The site procedures also defined the stiffness and massiveness threshold for inclusion in analyses to be a moment of inertia ratio of pipe run to branch pipe less than or equal to 10. The limits of IEB 79-14 walkdowns, therefore, represent an anchor or a combination of supports that correspond to NEI 95-10; Appendix F, Paragraph 4.3, “equivalent anchor,” which includes, “...a series of supports that have been evaluated as a part of a plant-specific piping design analysis to ensure that forces and moments are restrained in three orthogonal directions.” In some cases, the limit of IEB 79-14 walkdowns may represent an analysis boundary corresponding to a branch line with a moment of inertia ratio of greater than 10, consistent with NEI 95-10, Appendix F, Section 4, "alternative f” (a smaller branch line, for which the moment of inertia ratio must be determined on a plant-specific basis).

The results of the IEB 79-14 field walkdowns, including any as-built dimensional changes and pipe support modifications made as a result of the re-analysis, were shown on revised isometric drawings. In addition, the boundaries of the IEB 79-14 field walkdowns were noted on the isometrics. Thus, the analytical boundaries of the current piping calculations are depicted by the IEB 79-14 walkdown boundaries as shown on the isometrics. These boundaries were used to determine the limits of scoping for nonsafety-related piping components that are directly connected to safety-related components.

Therefore, relative to the use of isometric drawing notes identifying the limits of IEB 79-14 walkdowns, the license renewal scoping methodology used at BVPS did not preclude identification of any nonsafety-related components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1). No additional SSCs have been added to scope as a result of the response to this question.

Based on its review, the staff finds the applicant’s response to RAI 2.1-3 acceptable because the applicant has provided a description of a process used to ensure that SSCs have been appropriately included within the scope of license renewal, pursuant to 10 CFR 54.4(a)(2). The staff further finds that the applicant’s process was based on a stress analysis performed by the architectural engineer in response to IEB 79-14 and that the subsequent walkdowns, performed by BVPS personnel to identify seismic and equivalent anchors, was in accordance with the SRP-LR and the guidance found in NEI 95-10. Therefore, the staff’s concern described in RAI 2.1-3 is resolved.

Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs. The applicant considered physical impact (pipe whip, jet impingement), harsh environments, flooding, spray, and leakage when evaluating the potential for spatial interactions between nonsafety-related systems and safety-related SSCs. The applicant used a spaces approach to identify the portions of nonsafety-related systems with the potential for spatial interaction with safety-related SSCs. The 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 safety-related SSCs.

Physical Impact or Flooding. The applicant considered nonsafety-related supports for non-seismic piping systems with potential for spatial interaction with safety-related SSCs for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The applicant identified the nonsafety-related SSCs by performing a review of the engineering drawings (including operating manual figures, valve operating number diagrams, flow diagrams, piping and instrumentation drawings, and isometric drawings), equipment locations specified in the controlled operating manual valve lists, and system and component walk-downs, where needed. The applicant's review of earthquake experience identified no occurrence of welded steel pipe segments falling due to a strong motion earthquake. The applicant concluded that as long as the effects of aging on supports for piping systems are managed, falling of piping systems is not credible (except due to flow-accelerated corrosion as considered in the HELB analysis for high-energy systems) and; therefore, there is no requirement, due to a physical impact hazard, to include the piping sections within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). The applicant evaluated the missiles that could be generated from internal or external events such as failure of rotating equipment. The nonsafety-related design features which protect safety-related SSCs from such missiles were included within the scope of license renewal.

Pipe Whip, Jet Impingement, and Harsh Environment. The applicant evaluated nonsafety-related portions of high-energy lines against criteria pursuant to 10 CFR 54.4(a)(2). The applicant's evaluation was based on a review of documents such as the UFSAR, design documents and relevant site documentation. The applicant's high-energy systems were evaluated to ensure identification of components that are part of nonsafety-related high-energy lines that can effect safety-related equipment, and applicable portions of high-energy piping systems and associated mitigative features were included within the scope of license renewal.

Spray and Leakage. The applicant evaluated moderate and low-energy systems which have the potential for spatial interactions due to spray or leakage. Nonsafety-related systems and nonsafety-related portions of safety-related systems, with the potential for spray or leakage that could prevent safety-related SSCs from performing their required safety function were considered within the scope of license renewal. The applicant used a spaces approach to identify the nonsafety-related SSCs which were located within the same space as safety-related SSCs. As described in the LRA, a space was defined for the purposes of the review, as a structure containing safety-related SSCs. Following identification of the applicable mechanical systems, the applicant reviewed the system functions to determine whether the system contained fluid, air or gas.

Plant Based and Industry Operating Experience. The applicant excluded the nonsafety-related SSCs containing air or gas from the scope of license renewal. The applicant then determined whether the system had any components located within a space containing safety-related SSCs. Those nonsafety-related SSCs determined by the applicant to contain fluid, and located within a space containing safety-related SSCs, were included within the scope license renewal, in accordance with 10 CFR 54.4(a)(2).

Protective Features. The applicant evaluated protective features such as whip restraints, spray shields, supports, missile and flood barriers installed to protect safety-related SSCs against spatial interaction with nonsafety-related SSCs due to fluid leakage, spray, or flooding. Nonsafety-related structural components could affect safety-related SSCs due to their spatial interaction with the SSCs (*i.e.*, their physical location could result in interaction upon failure of the nonsafety-related structure). Structural components that meet the criterion pursuant to

10 CFR 54.4(a)(2) included missile barriers, flood barriers, HELB protection, and nonsafety-related supports for non-seismic (including seismic II and I) piping systems, electrical conduit, and cable trays with potential for spatial interaction with safety-related equipment. Protective features credited in the plant design and all equipment supports in safety-related areas were included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

During the audit, the staff determined that the TBs had been included within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(3). However, although the BVPS Unit 1 TB had the potential to affect safety-related SSCs, the applicant failed to identify the Unit 1 TB as within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) or (a)(2). Therefore, the staff required additional information to complete its review of the applicant's scoping methodology.

In RAI 2.1-5, dated March 5, 2008, the staff requested that the applicant provide a written evaluation to address the following:

(a) A safety-related portion of the Unit 1 river water pipe, which consists of a pipe and an elastic expansion joint, was included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). This portion of the river water pipe exits from the safety-related main steam cable vault pipe tunnel (included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1)) and enters the nonsafety-related TB. However, neither the TB, nor the nonsafety-related SSCs located in the TB and in the vicinity of the river water pipe, have been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) or (a)(2) as applicable. In addition, the river water pipe supports located in the TB, which provide structural support to the safety-related river water pipe, were not included within the scope of license renewal.

(b) The TB is contiguous with the main steam cable vault pipe tunnel with no wall or door providing separation between the interiors of the two structures. The main steam cable vault pipe tunnel is safety-related and contains safety-related SSCs, all of which are included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). However, neither the TB, nor the nonsafety-related SSCs located in the TB and in the vicinity of the opening to the main steam cable vault pipe tunnel, have been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

(c) The TB is adjacent to the safety-related service building which was included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). However, the TB, although directly adjacent to a safety-related structure, has not been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

In the response to RAI 2.1-5, dated April 3, 2008, the applicant stated, in part, the following:

(a) Interactions between nonsafety-related components and the mechanical piping components associated with the safety-related river water discharge line in the main steam cable vault pipe tunnel, and in the TB southwest corner, were evaluated for license renewal scoping. The function of these safety-related river water piping components is to provide a discharge flow-path for river water that has already performed its function of removing heat from plant components. However, piping pressure boundary integrity is not required for this function, and a loss of integrity would not result in a loss of discharge flow and, as documented in the Unit 1 UFSAR, would not result in loss of any safety-related function. Therefore, failure of nonsafety-related components that could result in loss of piping integrity would not result in loss of any safety function. The applicant also stated that crushing of the line (e.g., by pipe whip) was not part of the HELB analysis criteria, and is, therefore, considered a hypothetical failure resulting from system interdependencies that is not part of the CLB, and that has not been previously experienced. NEI 95-10 states that consideration of this type of failure is not required for license renewal scoping pursuant to 10 CFR 54.4(a)(2). The scoping methodology used by the applicant did not preclude identification of safety-related SSCs which should have been included within the scope of license renewal. Also, the civil AMR reports have been updated to clarify that component supports and commodities associated with in-scope components in the TBs are within the scope of license renewal. The applicant further stated that no additional SSCs were added as in-scope in accordance with either 10 CFR 54.4(a)(1) or (a)(2), as a result of RAI 2.1-5(a).

(b) The safety-related components in the main steam cable vault pipe tunnel are the river water discharge piping components (addressed above, piping integrity not required) and the auxiliary steam system isolation valves HYV-1AS-101A and 101B. These valves, their actuators and power supplies are safety-related (and in-scope) for their intended function of isolating the supply of auxiliary steam to the main steam cable vault and auxiliary building upon detection of high-temperature in those areas and to mitigate a downstream auxiliary steam line break in those buildings. The isolation function is active, and pressure boundary integrity of the valves is not required to prevent a supply of steam to downstream components, so loss of integrity would not cause a loss of function. The valves fail closed on loss of power, so loss of power would not result in a loss of function. The direct current (DC) panel source of power to each valve is protected by breakers that are coordinated to ensure that a circuit fault downstream of a valve's individual power supply breaker, which would result in this breaker tripping and loss of power to the valve, will not result in loss of the DC panel power supply. The applicant also stated that the failure of nonsafety-related components that could result in loss of piping integrity, or in loss of power to the valves, would not result in loss of any safety function. Therefore, for components within the main steam cable vault pipe tunnel and the adjacent nonsafety-related SSCs both in the pipe tunnel and in the TB, the license renewal scoping methodology used by the applicant did not preclude identification of safety-related SSCs which should have been included within the scope of license renewal, and did not preclude the identification of any nonsafety-related components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4 (a)(1). The applicant further stated that no additional SSCs were added as in-scope in accordance with either 10 CFR 54.4(a)(1) or (a)(2), as a result of RAI 2.1-5(b).

(c) The potential for the nonsafety-related TBs (Units 1 and 2) to fail and interact with the adjacent safety-related structure(s) was not initially identified in the LRA for BVPS. The TBs are currently within the scope of license renewal, with functions associated with 10 CFR 54.4(a)(3) identified. A function has been added to the TB's lists of intended functions to address the potential for their failure to result in spatial interactions with adjacent safety-related structures, pursuant to 10 CFR 54.4(a)(2). The applicant further stated that no additional SSCs were added as in-scope in accordance with either 10 CFR 54.4(a)(1) or (a)(2), as a result of RAI 2.1-5(c).

Based on its review, that staff finds the applicants response to RAI 2.1-5 acceptable because the applicant has provided a description of an adequate process used to ensure that SSCs, applicable to the river water pipe and the auxiliary steam isolation valves, were appropriately considered for inclusion within the scope of license renewal pursuant to 10 CFR 54.4(a)(2). The staff notes that the applicants review was based on information contained in the CLB for Units 1 and 2. In addition, the staff further finds that the applicant has determined that certain AMR clarifications are required for component supports and that additional functions, pursuant to 10 CFR 54.4(a)(2), should be included for the TBs based on their proximity to safety-related structures. Therefore, the staff's concerns described in RAI 2.1-5 are resolved.

2.1.4.2.3 Conclusion

Based on its review of the applicant's scoping process and sample systems, discussions with the applicant, and review of the information provided in the response to RAI 2.1-2, 2.1-3, and 2.1-5 the staff concludes that the applicant's methodology for identifying and including nonsafety-related SSCs, which could affect the performance of a safety-related SSCs within the scope of license renewal, is consistent with the scoping criteria of 10 CFR 54.4(a)(2) and; therefore, is acceptable.

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

2.1.4.3.1 Summary of Technical Information in the Application

In LRA Section 2.1.1.3, the applicant described the methodology for identifying those systems and structures within the scope of license renewal in accordance with the staff's criteria for five regulated events: (1) 10 CFR 50.48, "Fire Protection;" (2) 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants;" (3) 10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events;" (4) 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants;" and (5) 10 CFR 50.63, "Loss of All Alternating Current Power."

<u>Fire Protection</u>. In LRA Section 2.1.1.3.1, the applicant described the scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the fire protection criterion. The applicant stated that the SSCs within the scope of license renewal for fire protection include those based on several different

functional requirements as defined in 10 CFR 50.48 and 10 CFR Part 50, Appendix R. SSCs credited with fire prevention, detection and mitigation in areas containing equipment important to safe operation of the plant are in-scope, as is equipment credited to achieve safe-shutdown in the event of a fire. To establish this scope, the applicant performed a review of the Units 1 and 2, CLBs for fire protection to determine those SSCs relied upon to demonstrate compliance with NRC regulations that govern fire protection. The following documents were used as part of the review:

- UFSAR
- Station Procedure for the Fire Protection Program
- Fire Protection Appendix R and/or Safe Shutdown Report
- SERs
- Docketed Information

The applicant stated that based on the review of the Units 1 and 2, CLBs for fire protection, SSCs and their corresponding intended functions required for compliance with 10 CFR 50.48 were determined and included within the scope of license renewal.

Environmental Qualification. In LRA Section 2.1.1.3.2, the applicant described the scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function in compliance with the environmental qualification (EQ) criterion. The applicant stated that the Equipment Qualification Program for Units 1 and 2, contains documents that identify electrical equipment and components that are required to function during and subsequent to DBAs. The Unit 1 and 2 Electrical Equipment Qualification Master Lists document the CLBs for EQ of equipment at BVPS. Systems with equipment contained in these lists are included within the scope of license renewal. Based on the review of the CLBs for Units 1 and 2 for EQ, and the bounding scoping approach used for electrical equipment, systems and their corresponding intended functions that are required for compliance with 10 CFR 50.49, the applicant identified the SSCs included within the scope of license renewal.

Pressurized Thermal Shock. In LRA Section 2.1.1.3.3, the applicant described the scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the pressurized thermal shock (PTS) criterion. The applicant's review of docketed information did not identify any Units 1 and 2 systems or structures that are credited for protection against PTS. Protection is afforded by engineering analysis and core design. The applicant stated that plant conditions, specific to the reactor vessel (RV), are managed to ensure that the reference temperature for nil-ductility transition remains within limits, and no equipment other than the RV is credited with mitigation of PTS.

Anticipated Transient Without Scram. In LRA Section 2.1.1.3.4, the applicant described the scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the ATWS criterion. The applicant stated that the ATWS mitigation system actuation circuitry (AMSAC) was required to meet the requirements of 10 CFR 50.62 as described in the UFSAR. The AMSAC and other SSCs relied on in analyses or plant evaluations to sense, initiate, and perform these required functions have been included within the scope of license renewal for ATWS, in accordance with 10 CFR 54.4(a)(3).

Station Blackout. In LRA Section 2.1.1.3.5, the applicant described the scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the station blackout (SBO) criterion. The applicant stated that the

Station Blackout Shutdown Capability Summaries for each unit, the UFSAR for Units 1 and 2 and docketed information, document the CLBs for SBO. Based on the review of the CLBs for SBO blackout, and the bounding scoping approach used for electrical equipment, the applicant identified the SSCs and their corresponding intended functions required for compliance with 10 CFR 50.63, and included those SSCs within the scope of license renewal.

2.1.4.3.2 Staff Evaluation

The staff reviewed the applicant's approach to identifying mechanical systems and structures relied upon to perform functions that meet the requirements of the fire protection, EQ, PTS, ATWS, and SBO regulations.

As part of this review the staff discussed the methodology with the applicant, reviewed the documentation developed to support the approach, and evaluated a sample of the mechanical systems and structures indicated as within the scope of license renewal, in accordance with the criteria of 10 CFR 54.4(a)(3).

The staff noted that the applicant's implementing procedures described the process for identifying systems and structures within the scope of license renewal. These procedures state that all systems and structures that perform functions pursuant to 10 CFR 54.4(a)(3) are to be included within the scope of license renewal and that the results are to be documented in scoping results reports. The results reports reference the information sources used for determining the systems and structures credited for compliance with the regulated events.

Fire Protection. The applicant's scoping results reports indicated that it considered CLB documents to identify in-scope systems and structures. These documents included the UFSARs, station procedures for the fire protection program, fire protection Appendix R – safe-shutdown report, SERs and other docketed information. The staff reviewed the scoping results reports 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 found that the scoping results reports indicated which of the SSCs are included within the scope of license renewal because they perform intended functions that meet 10 CFR 50.48 requirements. The staff determines that the applicant's scoping methodology was adequate for including SSCs credited in performing fire protection functions.

Environmental Qualification. The applicant used the EQ master list to identify SSCs that meet the requirements of 10 CFR 50.49. The EQ master list includes system information, component identification numbers and descriptions. The staff reviewed the LRA, implementing procedures, scoping results reports, and the EQ master list to verify that the applicant has identified SSCs within the scope of license renewal. The staff determines that the applicant's scoping methodology was adequate for identifying EQ SSCs within the scope of license renewal.

Pressurized Thermal Shock. The applicant addressed PTS requirements for these components in a plant analysis. The staff reviewed the scoping report and determines that the methodology is appropriate for identifying SSCs with functions credited for complying with the PTS regulation and within the scope of license renewal. For this requirement the applicant has identified the RV as within the scope of license renewal.

Anticipated Transient Without Scram. The applicant's scoping results report identified SSCs which were included within the scope of license renewal because they perform intended functions that meet 10 CFR 50.62 requirements. The applicant determined the intended functions based on CLB information and identified most in-scope components as electrical equipment. The applicant also included mechanical systems with ATWS intended functions based on CLB information. The staff determines that this scoping methodology was adequate for identifying SSCs with functions credited for complying with the ATWS regulation and for including those SSCs within the scope of license renewal.

Station Blackout. The applicant's scoping results reports indicated the SSCs credited with performing intended functions to comply with the SBO requirement. In its scoping, the applicant considered the UFSAR and other docketed information as documented in a scoping report. The applicant included within the scope of license renewal electrical equipment, mechanical systems, and structures with intended functions meeting SBO requirements.

For scoping electrical equipment, the applicant's bounding methodology included within the scope of license renewal, all electrical and I&C systems by default. The staff determines that this scoping methodology was adequate for identifying SSCs with functions credited for complying with the SBO regulation. The staff's review and conclusion of the results of the implementation of the SBO scoping methodology is contained in Section 2.5.

2.1.4.3.3 Conclusion

Based on its review of the LRA, the staff concludes that the applicant's methodology for identifying systems and structures meets the scoping criteria pursuant to 10 CFR 54.4(a)(3) and; therefore, is acceptable. This conclusion is based on sample reviews, discussions with the applicant, and review of the applicant's scoping process.

2.1.4.4 Plant-Level Scoping of Systems and Structures

2.1.4.4.1 Summary of Technical Information in the Application

System and Structure Level Scoping. The applicant documented its methodology in the LRA for performing the scoping of SSCs in accordance with 10 CFR 54.4(a), guidance documents, and scoping and screening reports. The applicant's approach to system and structure scoping provided in the site guidance and implementing documents was consistent with the methodology described in LRA Section 2.1. Specifically, the guidance documents directed the personnel performing license renewal scoping to use CLB documents and to describe the system or structure, including a list of functions that the system or structure is required to accomplish. The applicant used sources of information included in the equipment database, UFSAR, SERs, maintenance rule, DBDs, plant engineering drawings, piping calculations, plant operating manuals and procedures, emergency operating procedures, and docketed correspondence. The applicant then compared identified system or structures function lists to the scoping criteria to determine whether the functions met the scoping criteria pursuant to 10 CFR 54.4(a). If any part of a system or structure met any of the license renewal scoping criteria, the system or structure was included within the scope of license renewal. The system and structure scoping results included an overall system and/or structure description, an evaluation of each of the scoping criteria pursuant to 10 CFR 54.4 and the basis for the applicant's conclusion. The applicant developed evaluation boundaries to document the system and structure level scoping determinations and to define the in-scope SSCs to support the subsequent screening and AMR processes. The applicant defined and documented the boundaries for the in-scope systems and structures for each discipline in a manner that assured the in-scope SSCs were included in the screening process.

Component Level Scoping. After identifying the intended functions of systems or structures within the scope of license renewal, the applicant performed a review to determine which components and structures support the system's license renewal intended functions. The applicant considered the components that support intended functions within the scope of license renewal and screened to determine whether an AMR was required. During this stage of the scoping methodology, the applicant considered the following three groups of SCs: (1) mechanical, (2) structural, and (3) electrical.

Commodity Groups Scoping. In LRA Sections 2.1.2.2.1 and 2.1.2.3.1, the applicant discussed the application of commodity group scoping to structural and electrical SCs.

Insulation. In LRA Section 2.1.2.1.1, the applicant stated that thermal insulation was credited for various applications wherever in-scope piping or structures are located and was included within the scope of license renewal. Thermal insulation was evaluated as a bulk structural commodity.

Consumables. In LRA Section 2.1.2.4, the applicant discussed the considerations of consumables included within the scope of license renewal. The applicant used the guidance found in SRP-LR Table 2.1-3 to categorize and evaluate consumables, and for purposes of license renewal, divided them into the following groups: (a) packing, gaskets, component seals, and O-rings; (b) structural sealants; (c) oil, grease, and component filters; and (d) system filters, fire extinguishers, fire hoses, and air packs.

Group (a). Packing, gaskets, component mechanical seals, and O-rings are typically used to provide a leakproof seal when components are mechanically joined together. These items are commonly found in components such as valves, pumps, heat exchangers, ventilation units or ducts, and piping segments. Based on ANSI B31.1 standards and the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section III, the subcomponents of these pressure retaining components are not pressure-retaining parts. Therefore, these subcomponents are not relied on to perform a pressure boundary intended function and were not subject to an AMR.

Group (b). Limited situations may exist where materials are important in maintaining the integrity of the components to which they are connected. These component types are subject to an AMR, and are included in the AMR of bulk commodities. Waterstops perform their functions without moving parts or change in configuration and are not typically replaced or accessible. They support a flood barrier intended function, since they form a tight seal against water intrusion under hydrostatic pressure in concrete construction joints. Structural sealants that provide pressure boundary, flood barrier, or fire barrier functions are also not typically replaced at a set schedule. These component types are subject to an AMR, and are included in the AMR bulk commodities.

Group (c). Oil, grease, and component filters have been treated as consumables because either (1) they are periodically replaced or (2) they are monitored and replaced based on condition, and are not subject to an AMR.

Group (d). Components such as system filters, fire hoses, fire extinguishers, and air packs are considered consumables and are routinely tested, inspected, and replaced when necessary.

Periodic inspection procedures specify the replacement criterion of these components that are routinely checked by tests or inspections. Therefore, while these consumables are within the scope of license renewal, they are not subject to an AMR.

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

The applicant documented the results of the plant-level scoping process in accordance with the guidance documents. Results were provided in the applicant's systems and structures documents and reports, which contained information including 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 requirements criteria met by the system or structure, references, and the basis for the classification of the system or structure intended functions. During the audit, the staff reviewed a sampling of the documents and reports and concludes that the applicant's scoping results contained an appropriate level of detail documenting the scoping process.

2.1.4.4.3 Conclusion

Based on its review of the LRA, scoping and screening implementation procedures, and a sampling of system scoping results during the audit, the staff concludes that the applicant's methodology identifies systems, structures, component types, and commodity groups within the scope of license renewal and their intended functions in accordance with the requirements of 10 CFR 54.4 and; therefore, is acceptable.

2.1.4.5 Mechanical Scoping

2.1.4.5.1 Summary of Technical Information in the Application

In addition to the information previously discussed in SER Section 2.1.4.4.1, in LRA Section 2.1.2.1, the applicant stated that for the mechanical scoping effort, summary-level boundary descriptions were developed, along with a set of license renewal mechanical boundary drawings. The applicant developed the mechanical boundary drawings from the Units 1 and 2 P&IDs, and identified mechanical components within the scope of license renewal in accordance 10 CFR 54.4(a)(1), (a)(2) and (a)(3) by highlighting and color-coding. The applicant clearly delineated end points for the portions within the scope of license renewal.

2.1.4.5.2 Staff Evaluation

The staff evaluated LRA Section 2.1.2.1 and the guidance in the applicant's implementing documents and reports to perform the review of mechanical scoping process. The project documents and reports provided instructions for identifying the evaluation boundaries. The staff required an understanding of system operations in support of intended functions in order to determine the mechanical system evaluation boundary.

This process was based on the review of information in the applicant's equipment data base, UFSAR, SERs, maintenance rule, DBDs, plant engineering drawings, piping calculations, plant operating manuals and procedures, emergency operating procedures, and docketed correspondence. The applicant documented evaluation boundaries for mechanical systems on license renewal boundary drawings that were created by highlighting and color-coding mechanical P&IDs to indicate the components within the scope of license renewal. The staff reviewed components within the evaluation boundary to determine whether they perform an intended function.

The applicant established intended functions based on whether a particular function of a component was necessary to support the system functions that met the scoping criteria.

The staff reviewed the implementation guidance and the CLB documents associated with mechanical system scoping, and found that the guidance and CLB source information noted above were acceptable in identifying mechanical components and support structures in mechanical systems that are within the scope of license renewal. The staff conducted detailed discussions with the applicant's license renewal project management 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 implementation procedures and whether the scoping results were consistent with CLB requirements.

The staff determined that the applicant's proceduralized methodology was consistent with the description provided in LRA Section 2.1 and the guidance contained in SRP-LR Section 2.1, and was adequately implemented.

The staff reviewed the applicant's methodology for identifying main steam and RHR mechanical component types that meet the scoping criteria as defined in the Rule. The staff also reviewed the applicant's scoping methodology implementation procedures and discussed the methodology and results with the applicant. The staff verified that the applicant has identified and used pertinent engineering and licensing information in order to determine the main steam and RHR mechanical component types required to be within the scope of license renewal. As part of the review process, the staff evaluated each system intended function that the applicant has identified for the main steam and RHRs, the basis for inclusion of the intended function, and the process used to identify each of the system component types. The staff verified that the applicant has identified, highlighted, and color-coded system P&IDs to develop the license renewal boundaries in accordance with the procedural guidance. The applicant was knowledgeable about the process and conventions for establishing boundaries as defined in the license renewal implementation procedures. Additionally, the staff verified that the applicant had independently verified the results in accordance with the governing procedures. Specifically, other license renewal personnel knowledgeable about the system had independently reviewed the marked-up drawings to ensure accurate identification of system intended functions. The applicant performed additional cross-discipline verification and independent reviews of the resultant highlighted drawings, before final approval of the scoping effort.

2.1.4.5.3 Conclusion

Based on its review of the LRA, scoping implementation procedures, and the sample system review and discussions with the applicant, the staff concludes that the applicant's methodology for identifying mechanical systems within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4 and; therefore, is acceptable.

2.1.4.6 Structural Scoping

2.1.4.6.1 Summary of Technical Information in the Application

In addition to the information previously discussed in LRA Section 2.1.4.4.1, in LRA Section 2.1.2.2, the applicant stated that for the structural scoping effort, the structures were determined to be within the scope of license renewal through a review of information in the UFSAR, SERs, maintenance rule, DBDs, plant engineering drawings, piping calculations, plant operating manuals and procedures, emergency operating procedures, and docketed correspondence. The applicant identified the structural SSCs intended functions and highlighted on layout drawings, those structures it determined to be within the scope of license renewal.

2.1.4.6.2 Staff Evaluation

The staff reviewed the applicant's approach for identifying structures relied upon to perform the functions pursuant to 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 several structures that the applicant has identified as within the scope of license renewal. The applicant identified and developed a list of plant structures and their intended functions through a review of information in the UFSAR, SERs, maintenance rule, DBDs, plant engineering drawings, piping calculations, plant operating manuals and procedures, emergency operating procedures, and docketed correspondence. Each structure was evaluated against the criteria pursuant to 10 CFR 54.4 (a)(1), (a)(2) and (a)(3).

The staff reviewed selected portions of the UFSAR, maintenance rule documents, design criteria, structural drawings, implementing procedures, and selected AMR reports to verify the adequacy of the applicant's methodology. In addition, the staff reviewed the scoping results, including information contained in the source documentation for the TB and the main intake structure to verify that application of the methodology would provide the results as documented in the LRA. The staff reviewed the applicant's methodology for identifying structures meeting the scoping criteria as defined in the Rule. The staff also reviewed the scoping methodology implementation procedures and discussed the methodology and results with the applicant. The staff verified that the applicant has identified and used pertinent engineering and licensing information in order to determine the TB and the main intake components required to be within the scope of license renewal. As part of the review process, the staff evaluated the intended functions identified for the TB and the main intake structure and the components, the basis for inclusion of the intended function, and the process the applicant used to identify each of the component types.

2.1.4.6.3 Conclusion

Based on its review of 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 structures within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4 and; therefore, is acceptable.

2.1.4.7 Electrical Scoping

2.1.4.7.1 Summary of Technical Information in the Application

In LRA Section 2.1.2, the applicant stated that the scoping process for electrical and I&C systems differed from that applied to mechanical systems and structures. Plant systems with electrical and I&C components are within the scope of license renewal regardless of the intended function of the system, which is the result of an "encompassing" or "bounding" review for electrical components. Electrical and I&C components in mechanical systems were included in the evaluation of electrical components. In LRA Section 2.5, the applicant stated that the electrical and I&C IPA began by grouping the total population of components into commodity groups.

The commodity groups include similar electrical and I&C components with common characteristics. Component level intended functions of the commodity groups were identified. During the IPA screening, some commodity groups were removed from further review.

2.1.4.7.2 Staff Evaluation

The staff evaluated LRA Sections 2.1.2 and 2.5, and the applicants implementing procedures and AMR reports that governed the electrical scoping methodology. The applicant reviewed the electrical and I&C systems in accordance with the requirements of 10 CFR 54.4 and determined which systems should be included within the scope of license renewal. During the scoping process, the applicant used the UFSAR, SERs, maintenance rule information, DBDs, plant engineering drawings, plant operating manuals and procedures, emergency operating procedures, and docketed correspondence.

All electrical and I&C components contained in plant systems and electrical systems contained in mechanical or structural systems were included within the scope of license renewal.

The applicant reviewed fuse-holders using the plant fuse documentation and drawings. The applicant reviewed the application of tie-wraps to determine whether credit had been taken in the CLB for tie-wrap use or whether nonsafety-related tie-wraps could affect a safety-related function, but did not identify any tie-wraps that should be included within the scope of license renewal. The staff reviewed selected portions of the data sources and selected several examples of components for which the applicant demonstrated the process used to determine electrical components were within the scope of license renewal.

2.1.4.7.3 Conclusion

Based on its review of the LRA, scoping implementation procedures, and a sampling review of electrical scoping results, the staff concludes that the applicant's methodology for identification of electrical components within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4 and; therefore, is acceptable.

2.1.4.8 Scoping Methodology Conclusion

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

2.1.5 Screening Methodology

2.1.5.1 General Screening Methodology

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

2.1.5.1.1 Summary of Technical Information in the Application

In LRA Section 2.1.2, the applicant discussed the process for determining which components and structural elements require an AMR. Screening identifies SCs, within the scope of license renewal that perform an intended function as described in 10 CFR 54.4, without moving parts or without a change in configuration or properties, and that are not subject to replacement based on a qualified life or specified time period. The screening process is as follows:

(1) Determine the SCs subject to an AMR by determining the system evaluation boundaries, which define those portions of the mechanical system that are necessary to ensure that the intended functions of the system will be performed.

(2) Establish system scoping boundaries which are depicted on license renewal drawings by highlighting. Highlighted components perform functions that correspond to the functions specified in 10 CFR 54.4(a)(1), (a)(2) or (a)(3).

(3) Identify components that are passive and long-lived and subject to an AMR.

2.1.5.1.2 Staff Evaluation

Pursuant to 10 CFR 54.21, each LRA must contain an IPA that identifies SCs within the scope of license renewal and 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). The IPA includes a description and justification of the methodology used to determine the passive and long-lived SCs, and a demonstration that the effects of aging on those SCs will be adequately managed so that the intended function(s) will be maintained under all design conditions imposed by the plant-specific CLB, for the period of extended operation.

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

The screening process evaluated the component types and commodity groups included within the scope of license renewal, to determine which ones were passive and long-lived and therefore, subject to an AMR. The staff reviewed LRA Sections 2.3, 2.4 and 2.5 that provide the results of the process the applicant used to identify component types and commodity groups subject to an AMR. The staff also reviewed the applicant's screening results reports for main steam, the RHR, the TB and the main intake structure.

The applicant provided the staff with a detailed discussion of the processes used for each discipline and provided administrative documentation that described the screening methodology. Specific methodology for mechanical, electrical, and structural is discussed below.

2.1.5.1.3 Conclusion

Based on its review of the LRA, the screening implementation procedures and a sampling of screening results, the staff concludes that the applicant's screening methodology was consistent with the guidance contained in the SRP-LR and was capable of identifying passive, long-lived components within the scope of license renewal that are subject to an AMR. The staff determines that the applicant's process for identifying 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

In LRA Section 2.1.2.1, the applicant discussed the screening methodology for identifying passive and long-lived mechanical components and their support structures that are subject to an AMR. The applicant prepared LRA drawings to indicate portions of systems that support system intended functions within the scope of license renewal. For mechanical systems, the applicant used a systematic process to identify the components that require an AMR that includes (a) identifying the in-scope SCs and associated component types using the license renewal mechanical boundary information and drawings created during the scoping process and (b) reviewing the components within the boundary to determine whether the passive, long-lived component's intended functions supported the system intended function. The components that contribute to the performance of a system intended function, perform their function without moving parts and without a change in configuration or properties, and are not subject to replacement based on a qualified life or specified time period, were subject to an AMR.

2.1.5.2.2 Staff Evaluation

The staff evaluated the mechanical screening methodology discussed and documented in LRA Section 2.1.2.1, the implementing guidance documents, the AMR reports, and the LRA drawings. The mechanical system screening process began with the results from the scoping process. The applicant reviewed each system evaluation boundary as illustrated on P&IDs to identify passive and long-lived components that perform or support an intended function and were determined to be subject to an AMR. The results of the review are documented in the AMR reports that contain information such as the information sources reviewed and the system intended functions.

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

The staff reviewed selected portions of the equipment database, design criteria documents, the UFSAR, plant drawings, maintenance rule scoping documents, and selected AMR reports.

The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process.

The staff assessed whether the mechanical screening methodology, outlined in the LRA and procedures, was appropriately implemented and whether the scoping results were consistent with CLB requirements. The staff also reviewed the mechanical screening results for the main steam and RHRs to verify proper implementation of the screening process. Based on these audit activities, the staff did not identify any discrepancies between the methodology documented and the implementation results.

2.1.5.2.3 Conclusion

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

2.1.5.3 Structural Component Screening

2.1.5.3.1 Summary of Technical Information in the Application

In LRA Section 2.1.2.2, the applicant stated that for each structure within the scope of license renewal, the structural components and commodities were evaluated to determine those subject to an AMR. This evaluation (screening process) for structural components and commodities involved a review of the UFSAR, DBDs, design drawings, general arrangement drawings, and penetration drawings, to identify specific structural components and commodities that make up the structure. Since structures are inherently passive, and with few exceptions are long-lived, the screening of structural components and commodities was based primarily on whether they perform an intended function.

The applicant stated that structural components and commodities, unlike mechanical components, often have no unique identifiers. Therefore, grouping structural components and commodities based on materials of construction provided a practical means of categorizing them for AMRs. The applicant categorized structural components and commodities by groups based on materials of construction. Commodity groups were subdivided into discrete structural component types based on design, since component types may have different intended functions as defined pursuant to 10 CFR 54.4(a).

2.1.5.3.2 Staff Evaluation

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

The staff reviewed the applicant's methodology used for structural screening described in LRA Section 2.1.2.2, and in the applicants implementing guidance and AMR reports. The applicant performed the screening review in accordance with the implementation guidance and captured pertinent structure design information, component, materials, environments, and aging effects.

The staff verified that the applicant had determined that structures are inherently passive and long-lived, such that the screening of structural components and commodities was based primarily on whether they perform an intended function. Structural components were grouped as commodities based on materials of construction. The primary task performed by the applicant during the screening process was to evaluate structural components to identify intended functions as they relate to license renewal. The applicant provided the staff with a detailed discussion that described the screening methodology, as well as the screening reports for a selected group of structures.

The staff reviewed selected portions of the UFSAR, DBDs, design drawings, general arrangement drawings, and penetration drawings, implementing procedures and selected AMR reports. The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process. The staff assessed whether the screening methodology outlined in the LRA and procedures was appropriately implemented and whether the scoping results were consistent with CLB requirements. The staff also reviewed structural screening results for the TB and the main intake structure to verify proper implementation of the screening process. Based on these audit activities, the staff did not identify any discrepancies between the methodology documented and the implementation results.

2.1.5.3.3 Conclusion

Based on its review of information contained in the LRA, the applicant's detailed screening implementation procedures, and a sampling review 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 is in accordance with the requirements of 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.1.5.4 Electrical Component Screening

2.1.5.4.1 Summary of Technical Information in the Application

In LRA Section 2.1.2.3, the applicant stated that active components for Units 1 and 2 are not subject to an AMR, pursuant to 10 CFR 54.21(a)(1)(i). The ability of active components (*e.g.*, transformers, breakers, relays, or switches) to perform their intended functions is assured through condition and performance monitoring in accordance with the maintenance rule. Electrical cables and connections located inside active component enclosures are considered part of the active component, and are inspected and maintained along with the other subcomponents and piece-parts; therefore, these cables, connections, and other subcomponents are not subject to an AMR. The electrical commodity groups for Units 1 and 2 were identified and cross-referenced to the appropriate NEI 95-10 commodity, which identified the passive commodity groups.

Two passive electrical and I&C commodity groups that meet the 10 CFR 54.21(a)(1)(i) criterion (i.e., components that perform an intended function without moving parts or without a change in configuration) were identified:

- High-voltage insulators
- Cables and connections, bus, electrical portions of electrical and I&C penetration assemblies, fuse holders outside of cabinets of active electrical structures or components

2.1.5.4.2 Staff Evaluation

The staff reviewed the applicant's methodology used for electrical screening in LRA Sections 2.1.2.3 and the applicant's implementation procedures and AMR reports.

The applicant used the screening process described in these documents to identify the electrical commodity groups subject to AMR. The applicant used the information contained in NEI 95-10, plant documents and drawings and the EQ master list as data sources to identify the electrical and I&C components.

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

2.1.5.4.3 Conclusion

Based on its review of the LRA, procedures, electrical drawings, and a sample of the results of the screening methodology, the staff determines that the applicant's methodology was consistent with the description provided in LRA and the applicant's implementing procedures. Based on its review of information contained in the LRA, the applicant's screening implementation procedures, and a sampling review of electrical screening results, the staff concludes that the applicant's methodology for identification of electrical commodity groups within the scope of license renewal and subject to an AMR is in accordance with the requirements of 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.1.5.5 Conclusion for Screening Methodology

Based on its review of the LRA, the screening implementation procedures, discussions with the applicant's staff, and a sample review of screening results, the staff determines 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

The staff review of the information presented in LRA Section 2.1, the supporting information in the scoping and screening implementation procedures and reports, the information presented during the scoping and screening methodology audit, and the applicant's responses to the staff's RAIs dated April 3, 2008, formed the basis of the staff's determination.

The staff verified that the applicant's scoping and screening methodology was consistent with the requirements of the Rule. From this review, the staff concludes that the applicant's methodology for identifying SSCs within the scope of license renewal and SCs requiring an AMR is consistent with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.2 Plant-Level Scoping Results

2.2.1 Introduction

In LRA Section 2.1, the applicant described its methodology for identifying systems, SSCs within the scope of license renewal and subject to an AMR. The applicant applied the scoping methodology to determine which systems and structures must be included within the scope of license renewal as required by 10 CFR 54.4(a). The applicant provided the results of its review in LRA Section 2.2.

The staff reviewed the applicant's plant-level scoping results to determine whether the applicant had properly identified SSCs belonging to the following groups: (1) safety-related SSCs which are relied upon to remain functional during and following DBEs, as required by 10 CFR 54.4(a)(1); (2) all nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of any of the functions pursuant to 10 CFR 54.4(a)(1) (i), (ii), or (iii), as required by 10 CFR 54.4(a)(2); and (3) all SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with other NRC regulations for fire protection, EQ, PTS, ATWS, and SBO, as required by 10 CFR 54.4(a)(3).

2.2.2 Summary of Technical Information in the Application

In LRA Tables 2.2-1, 2.2-3 and 2.2-4, the applicant listed plant mechanical systems, structures, and electrical and I&C systems within the scope of license renewal. In LRA Tables 2.2-2 and 2.2-5, the applicant listed the plant mechanical systems and structures, respectively that are not within the scope of license renewal. Systems and structures that only exist at one unit are marked in the tables, as appropriate. 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.

In LRA Section 2.1.1.2, the applicant described the license renewal scoping methodology used in identifying applicable systems and structures for spatial interactions. The applicant evaluated non-connected, nonsafety-related systems for their potential to adversely affect safety-related systems and structures. The applicant then included nonsafety-related systems with the potential to adversely affect safety-related systems and structures within the scope of license renewal to protect safety-related systems and structures from the consequences of failures of the nonsafety-related systems.

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 focused its review on the implementation results shown in LRA Tables 2.2-1, 2.2-2, 2.2-3, 2.2-4, and 2.2-5 to confirm that there were no omissions of plant-level systems and structures required to be included within the scope of license renewal in accordance with 10 CFR 54.4.

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

The staff reviewed LRA Section 2.1.1.2, Application of Criterion for Nonsafety-Related SSCs Whose Failure Could Prevent the Accomplishment of Safety Functions, and the FSAR using the evaluation methodology described in SER Section 2.1 and the guidance in SRP-LR Section 2.1. The staff reviewed sections of the FSAR, based on the systems and structures listed in LRA Tables 2.2-1, 2.2-2, 2.2-3, 2.2-4, and 2.2-5, to determine if there were any systems or structures that may have intended functions within the scope of license renewal, as defined by 10 CFR 54.4, but were omitted from the scope of license renewal.

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

During the review of LRA Section 2.2, the staff identified areas in which additional information was necessary to complete the review of the applicant's plant-level scoping results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.2-1, dated April 17, 2008, the staff noted that in LRA Table 2.2-2, the applicant identified the Unit 1 area ventilation systems - auxiliary building, as not within the scope of license renewal. However, the UFSAR for BVPS states that the Unit 1 area ventilation systems – auxiliary building, performs the following two functions. First, the Unit 1 area ventilation systems – auxiliary building, use automatic dampers contained in the system to divert the exhaust air stream to one of the supplementary leak collection and release system filter banks upon a high-high radiation alarm. Second, the charging pump cubicles' ventilation subsystem is relied upon to provide a level of fire protection equivalent to 10 CFR Part 50 Appendix R, Section III.G.2. The staff requested that the applicant explain why the Unit 1 area ventilation systems – auxiliary building are not within the scope of license renewal pursuant to criterion in 10 CFR 54.4(a)(1)(iii), for prevention or mitigation of the consequences of accidents that could result in potential offsite exposure in excess of limits. The staff also requested that the applicant explain why the portions of the system necessary for fire protection regulations identified in the other UFSAR function, were not included within the scope as required by 10 CFR 54.4(a)(3).

In its response to RAI 2.2-1, dated May 19, 2008, the applicant addressed both issues concerning the UFSAR functions of the BVPS Unit 1 area ventilation systems - auxiliary building. First, in regards to the automatic dampers the applicant stated:

> The diversion of the Beaver Valley Power Station (BVPS) Unit 1 Auxiliary Building ventilation exhaust to and its filtration by the Supplementary Leak Collection and Release System (SLCRS) upon high-high radiation, is described in, but is not credited by the Unit 1 Updated Final Safety Analysis Report (UFSAR), Section 9.13.2 as a safety-related function, and is not required to limit offsite doses to within limits.

The applicant cited other UFSAR references for Unit 1 that clarify that the diversion function is not required to limit offsite doses. The applicant stated that the supplementary leak collection and release system does not rely on the auxiliary building ventilation exhaust diversion function. Therefore, the diversion function of the area ventilation systems - auxiliary building, does not meet the requirements of 10 CFR 54.4(a)(1)(iii); however, the auxiliary building ventilation ductwork that is attached to the supplementary leak collection and release system ventilation ductwork is included within scope of license renewal for structural integrity pursuant to 10 CFR 54.4(a)(2). The ductwork is evaluated under the supplementary leak collection and release system for its function in accordance with 10 CFR 54.4(a)(2). Consequently, the applicant concluded that the Unit 1 area ventilation systems - auxiliary building, does not perform a diversion function requiring it to be within the scope of license renewal pursuant to 10 CFR 54.4(a)(1).

Secondly, in regards to the Unit 1 charging pump cubicle ventilation subsystem used to meet 10 CFR Part 50, Appendix R, Section III.G.2, the applicant explained that post-fire ventilation subsystem in the charging pump cubicles that is credited to achieve safe-shutdown is considered to be part of the supplementary leak collection and release system.

The charging pump cubicle ventilation provided by the supplementary leak collection and release system is listed in LRA Section 2.3.3.32 as within the scope of license renewal based upon its fire protection intended function, as required by 10 CFR 54.4(a)(3). The applicant pointed out that the charging pump cubicle ventilation is shown as in-scope on LR Drawing 1-16-1 (grids E-1 and F-1) and in LRA Section 2.3.3.32, and it includes the 10 CFR 54.4(a)(3) function for ventilation of the charging pump cubicles.

Based on its review, the staff finds the applicant's response to RAI 2.2-1 acceptable because the applicant has provided sufficient supporting documentation that clarified that the Unit 1 auxiliary building ventilation exhaust diversion through the supplementary leak collection and release system filter banks on high-high radiation is not credited to limit offsite exposure in accordance with 10 CFR 54.4(a)(1)(iii); therefore, it is not required to be included within the scope of license renewal. Further, the applicant clarified that the charging pump cubicles' ventilation subsystem is within scope and is evaluated within the supplementary leak collection and release system as described in LRA Section 2.3.3.32. Therefore, the staff's concern described in RAI 2.2-1 is resolved.

In RAI 2.2-2, dated April 17, 2008, the staff noted that in LRA Table 2.2-2, the applicant identified the emergency response facility (ERF) FPS as a mechanical system not within the scope of license renewal. The ERF FPS is located, in part, within the ERF diesel generator building structure. In LRA Sections 2.4.11 and 2.4.12, the applicant identifies the ERF diesel generator building structure and the ERF substation building structure as within the scope of license renewal pursuant to the criterion found in 10 CFR 54.4(a)(3), because they provide structural or functional support required to meet the NRC regulations for fire protection. The staff requested that the applicant explain why the ERF FPS was excluded as a mechanical plant system from the scope of license renewal.

In its response to RAI 2.2-2, dated May 19, 2008, the applicant stated:

> The Emergency Response Facility Substation (ERFS) System switchgear components in the ERFS building, and the Emergency Response Facility (ERF) diesel generator in the ERF Diesel Generator Building, support in-plant equipment used to establish safe shutdown during an in-plant fire by providing a non safety-related, independent source of power. The ERFS building and the ERF Diesel Generator Building contain fire detection and protection equipment that is not in the scope of license renewal because the ERFS System equipment has been evaluated in accordance with 10 CFR 50.48 and documented as not requiring fire protection. The basis for this conclusion is that a coincident ERFS fire and in-plant fire is not postulated. The ERFS is separated from the contiguous plant areas that could require its power to the extent that a fire in those plant areas could not spread to the ERFS and affect its ability to provide power to achieve or maintain safe-shutdown. Similarly, a fire in the ERFS resulting in loss of this non safety-related power source could not spread to in-plant areas where it could affect the ability to achieve and maintain safe-shutdown. Additionally, AMSAC equipment powered from the ERFS is credited for the mitigation of ATWS events; however, a coincident ERFS fire and an ATWS are not postulated. A fire in the ERFS would not affect the ability to

> achieve or maintain safe-shutdown and would not affect the ability to minimize and control a release of radioactivity. FirstEnergy Nuclear Operating Company (FENOC) has revised (change notices CN 08-059 and CN 08-060) the BVPS Unit 1 and Unit 2 UFSARs to include the ERFS and ERF Diesel Generator Buildings in Table 9.10-2 (Unit 1) and Table 9.5-12 (Unit 2), "Areas in which Fire Detection / Suppression is Outside the Scope of 50.48 Fire Protection." UFSAR changes are submitted to the NRC in accordance with 10 CFR 50.71(e).

Based on its review, the staff finds the applicant's response to RAI 2.2-2 acceptable, because the applicant has clarified that a coincident ERF substation and in-plant fire are not postulated because they are separated from each other and ERF substation system equipment is identified in the CLB as not requiring fire protection in accordance with 10 CFR 50.48. Therefore, the staff's concern described in RAI 2.2-2 is resolved.

In RAI 2.2-3, dated May 8, 2008, the staff noted that in LRA Table 2.2-5, the applicant identified the north pipe trench as a structure not within the scope of license renewal. On the LRA drawing showing plant structures, the applicant shows that the north pipe trench is adjacent to the valve pit structure, which is a structure that is within the scope of license renewal and is a safety-related, seismic Category I structure. The staff requested that the applicant verify that there are appropriate measures that prevent interaction between the north pipe trench and the valve pit structure, and that there is no piping between the north pipe trench and valve pit structure.
In its response to RAI 2.2-3, dated June 9, 2008, the applicant stated:

> The North Pipe Trench has been added to the scope of License Renewal (see FirstEnergy Nuclear Operating Company (FENOC) Letter L-08-150 dated May 8, 2008, because the scoping endpoint of a non safety-related pipe directly attached to safety-related piping in the BVPS, Unit 2, valve pit, was determined to be located within the North Pipe Trench.
>
> (a) The safety-related BVPS Unit 2 Valve Pit is isolated from interaction with the nonsafety-related North Pipe Trench by a 4-inch shake space.
>
> (b) There is only one pipe that runs between the safety-related Unit 2 Valve Pit and the non safety-related North Pipe Trench, and the pipe is within scope for leakage boundary and structural integrity (attached) within the Valve Pit. The final support credited for the equivalent anchor associated with this pipe is located within the North Pipe Trench.

Based on its review, the staff finds the applicant's response to RAI 2.2-3 acceptable because the applicant has added the structure "north pipe trench" and applicable components to the scope of license renewal. Therefore, the staff's concern described in RAI 2.2-3 is resolved.

2.2.4 Conclusion

The staff review of LRA Section 2.2, the UFSAR, RAI responses, and applicable drawings found instances where the applicant omitted systems and structures that should have been included within the scope of license renewal. The applicant has satisfactorily resolved the issues as discussed in the preceding staff evaluation.

Based on its review, the staff concludes that the applicant has appropriately identified the systems and structures within the scope of license renewal as required by 10 CFR 54.4; therefore, it is acceptable.

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:

- RV, RV internals, and reactor coolant system (RCS)
- engineered safety features (ESF)
- auxiliary systems
- steam and power conversion systems

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

The staff's evaluation of the information in the LRA for all mechanical systems used the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The objective was to determine whether the applicant has identified, in accordance with 10 CFR 54.4, components and supporting structures for mechanical systems that meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived components were subject to an AMR in accordance with 10 CFR 54.21(a)(1).

In its scoping evaluation, the staff reviewed the applicable LRA sections and drawings, focusing on components that had not been identified as within the scope of license renewal. For each mechanical system, the staff reviewed relevant licensing basis documents (*e.g.*, UFSAR) to determine whether the applicant specified all intended functions and did not omit any components from the scope of license renewal with intended functions delineated pursuant to 10 CFR 54.4(a). The staff requested additional information to resolve any omissions or discrepancies identified. After its review of the scoping results, the staff evaluated the applicant's screening results. For those SCs with intended functions delineated pursuant to 10 CFR 54.4(a), the staff verified that the applicant properly screened out SCs that have functions performed with moving parts or a change in configuration or properties and SCs that are subject to replacement after a qualified life or specified time period, in accordance with 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff confirmed that these 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.

Two-Tier Scoping Review Process for BOP Systems

There are 48 mechanical systems within the scope of license renewal as documented in the LRA, among which, 34 are balance of plant (BOP) systems. These 34 systems include most of the auxiliary systems and all the steam and power conversion systems. The staff performed a two-tier scoping review for these BOP systems.

In the two-tier scoping review, the staff reviewed the LRA and UFSAR descriptions, focusing on the system intended function, to screen all the BOP systems into two groups: (1) a simplified review, Tier 1 and (2) a more detailed review, Tier 2. The staff selected systems for a detailed Tier 2 review based on systems having the following screening criteria:

- safety importance and/or risk significance
    - high safety significant systems
    - common cause failure of redundant trains
- operating experience indicating likely passive failures
- previous LRA review experience

Examples of the systems that typically have a high safety importance and/or risk significant are the emergency diesel generator (EDG) system, EDG support systems, and the emergency service water system (SWS). A drain system is an example of a system whose failure could result in common cause failure of redundant trains based upon providing flood protection. Main steam, feedwater, and SWSs are examples of systems with industry operating experience that would indicate likely passive failures. Examples of systems with omissions identified in previous LRA reviews include the spent fuel cooling system and makeup water sources to safety systems.

Tier 1 Review Results

The staff selected the following BOP systems for a simplified Tier 1 review, and determined no additional information was required to complete its review of the applicant's scoping and screening results:

- 2.3.3.10 domestic water system
- 2.3.3.20 gaseous waste disposal system
- 2.3.3.21 liquid waste disposal system
- 2.3.4.3 building services hot water heating system
- 2.3.4.4 condensate system (Unit 1 only)
- 2.3.4.5 glycol heating system (Unit 1 only)

For systems receiving a simplified Tier 1 review, the staff verified that the applicant included the intended function described in corresponding UFSAR sections in the applicable LRA section. Also, the staff verified that the applicant did not omit any component types that are typically found within the scope of license renewal.

The staff review of the LRA and the UFSAR for these systems did not find any omissions where the applicant failed to identify any SCs within the scope of license renewal as required by 10 CFR 54.4(a). In addition, the staff did not find any omissions where the applicant failed to identify any component types typically subject to an AMR.

Based on its review, the staff concludes for these Tier 1 BOP systems listed above, that the applicant has adequately identified the system components required to be included within the scope of license renewal in accordance with 10 CFR 54.4(a) and had identified those components subject to an AMR in accordance with 10 CFR 54.21(a)(1); therefore, are acceptable.

For the following system selected for a Tier 1 review, the staff required specific additional information in order to complete its review of the applicant's scoping and screening results:

- 2.3.3.21 liquid waste disposal system

The staff's evaluation and findings for this system is discussed in SER Section 2.3.3.

<u>Tier 2 Review Results</u>

For systems selected for a more detailed Tier 2 review, the staff reviewed the LRA, UFSAR, and detailed boundary drawings to determine whether the applicant failed to identify any components required to be included within the scope of license renewal and subject to an AMR. During its review, the staff used the system functions described in the LRA and UFSAR to review the detailed boundary drawings in order to verify that the applicant did not omit any components with intended functions pursuant to 10 CFR 54.4(a), from the scope of license renewal. The staff compared the components indentified as within scope of license renewal to the list of component types that the applicant indentified in the LRA section, in order to verify that the applicant has not omitted any passive and long-lived components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

A minimum of 50 percent of the BOP systems received a detailed Tier 2 review, as described below.

The staff performed a detailed Tier 2 review of the following BOP systems and required no specific additional information to complete its review of the applicant's scoping and screening results:

- 2.3.3.6 chilled water system
- 2.3.3.11 emergency diesel generators and air intake and exhaust system
- 2.3.3.13 emergency diesel generators - crankcase vacuum system
- 2.3.3.15 emergency diesel generators – lube oil system
- 2.3.3.24 post-design basis accident hydrogen control system
- 2.3.3.28 river water system (Unit 1 only)
- 2.3.4.2 auxiliary steam system
- 2.3.4.8 main turbine and condenser system
- 2.3.4.10 water treatment system

The staff reviewed the LRA, UFSAR, and the detailed boundary drawings for the systems described above to determine whether the applicant failed to identify any components that should have been included within the scope of license renewal and subject to an AMR. Based upon the system functions described in the LRA and UFSAR, the staff verified the applicant has not omitted from the scope of license renewal any components required to meet the intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed the components identified to be within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR in accordance with 10 CFR 54.21.

For the systems identified above, the staff finds no omissions. Based on its review, the staff concludes that the applicant has adequately identified the system 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); therefore, they are acceptable.

The staff performed a detailed Tier 2 review of the following BOP systems and determined specific additional information was necessary to complete its review of the applicant's scoping and screening results:

- 2.3.3.4 building and yard drains system
- 2.3.3.7 compressed air system
- 2.3.3.12 emergency diesel generators - air start system
- 2.3.3.14 emergency diesel generators - fuel oil system
- 2.3.3.16 emergency diesel generators - water cooling system
- 2.3.3.17 emergency response facility substation system (common)
- 2.3.3.19 fuel pool cooling and purification system
- 2.3.3.22 post-accident sample system
- 2.3.3.25 radiation monitoring system
- 2.3.3.26 reactor plant sample system
- 2.3.3.27 reactor plant vents and drains
- 2.3.3.29 security diesel generator system (common)
- 2.3.3.30 service water system (Unit 2 only)
- 2.3.3.31 solid waste disposal system
- 2.3.3.32 supplementary leak collection and release system
- 2.3.4.1 auxiliary feedwater system
- 2.3.4.6 main feedwater system
- 2.3.4.7 main steam system
- 2.3.4.9 steam generator blowdown system

The staff's evaluation and findings for these systems are discussed in SER Sections 2.3.3 and 2.3.4.

2.3.1 Reactor Vessel, Internals, and Reactor Coolant System

In LRA Section 2.3.1, the applicant identified the RV, internals, and reactor coolant system SCs subject to an AMR for license renewal.

The applicant described the supporting SCs of the RV, internals, and reactor coolant system in the following LRA sections:

- 2.3.1.1 reactor vessel
- 2.3.1.2 reactor vessel internals
- 2.3.1.3 reactor coolant system

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

2.3.1.1 Reactor Vessel

2.3.1.1.1 Summary of Technical Information in the Application

In LRA Section 2.3.1.1, the applicant described the RV, a vertical, cylindrical pressure vessel with a welded hemispherical bottom head and a removable bolted, flanged, and gasketed hemispherical upper closure head. The vessel contains the core, core support structures, control rods, and other vessel internals directly associated with the core.

Reactor coolant flows into and out of the RV through three inlet and three outlet nozzles spaced evenly around it. Pads on the bottoms of these six nozzles support the vessel. The RV closure head has penetrations for the control rod drive mechanisms and core instrumentation. The Unit 1 closure head was replaced during Refueling Outage 17 in the spring of 2006. The bottom head of the vessel has penetrations for the in-core instrumentation.

The RV internal surfaces in contact with primary coolant are clad with a weld overlay of stainless steel. The RV exterior is insulated with canned stainless steel reflective sheets (Units 1 and 2) and canned borated fiberglass (Unit 2 only).

The RV contains safety-related components relied upon to remain functional during and following DBEs. In addition, the RV performs functions that support PTS.

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

- bottom-mounted guide tube
- closure heat
- core support pad and core guide lug
- head penetration
- nozzle safe end and weld
- nozzle
- penetration
- refueling seal ledge ring
- vessel shell

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

- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- support - structural, functional, or both - to maintain system functions

2.3.1.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.1 and UFSAR Section 4.2.2 for Unit 1 and UFSAR Section 5.3.3 for Unit 2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.1.1.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the RV 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) and; therefore, is acceptable.

2.3.1.2 Reactor Vessel Internals

2.3.1.2.1 Summary of Technical Information in the Application

In LRA Section 2.3.1.2, the applicant described the RV internals, which consist of three major assemblies: (1) the lower core support structure (also known as the "lower internals"), (2) the upper core support structure (also known as the "upper internals"), and (3) the in-core instrumentation support structure (includes component parts of the "upper internals" or the "lower internals"). These assemblies support the core; align, guide, and limit movement of core components; direct coolant flow; and provide shielding.

The lower core support structure assembly consists of the core barrel, the core baffle, the lower core plate and support columns, the thermal shield or neutron shield pads, and the core support welded to the core barrel. A ledge in the RV supports the lower core support structure at its upper flange and a radial support system attached to the vessel wall restrains its lower end from transverse motion. Within the core barrel, an axial baffle and a lower core plate are attached to the core barrel wall and form the enclosure periphery of the assembled core. The lower core support structure and core barrel control and provide passageways for coolant flow. The lower core plate positioned at the bottom level of the core below the baffle plates supports and orients the fuel assemblies.

Unit 1 uses a one-piece thermal shield fixed to the core barrel at the top with rigid bolted connections. Rectangular specimen guides, welded to the outside of the thermal shield for insertion and irradiation of material samples during reactor operation, extend to the top of the thermal shield. Unit 2 uses a neutron shield pad assembly consisting of four pads bolted and pinned to the outside of the core barrel. Specimen guides, for insertion and irradiation of material surveillance samples during reactor operation, are attached to the outside of the pads.

The upper core support structure consists of the upper support assembly and the upper core plate, between which, are support columns and rod cluster control (RCC) guide tube assemblies. The support columns establishing the spacing between the upper support assembly and the upper core plate are fastened at the top and bottom to these plates. They transmit mechanical loadings between the upper support and upper core plate and serve as thermocouple passageways.

The RCC guide tube assemblies that shield and guide the control rod drive shafts and control rods assemblies are fastened to the upper support and oriented and supported by pins in the upper core plate. The upper guide tube attached to the upper support plate and guide tube also guides the control rod drive shafts.

The in-core instrumentation support structures consist of an upper system (components of which are parts of the “upper internals”) to support and convey thermocouples penetrating the vessel through the head and a lower system (components of which are parts of the “lower internals”) to support and convey flux thimbles penetrating through the bottom.

The upper system has instrumentation port columns, slip-connected to in-line columns fastened, in turn, to the upper support plate. The thermocouples, conveyed through these port columns and the upper support plate, are above their readout locations.

The lower in-core instrumentation support system uses RV bottom-mounted instrumentation columns (flux thimble guide tubes) which guide and protect the retractable, cold-worked stainless steel flux thimbles that are pushed upward into the reactor core. The thimbles, closed at the leading ends, are the pressure barrier between the reactor pressurized water and the containment atmosphere. All reactor vessel internals are removable for their inspection, and for inspection of the vessel internal surface .

The RV internals contains safety-related components relied upon to remain functional during and following DBEs.

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

- core baffle/former assembly
- core barrel assembly
- instrumentation support structure
- lower internals assembly
- rod cluster control guide tube assemblies
- upper internals assembly

The intended functions of the RV internals component types within the scope of license renewal include:

- control of flow distribution or direction
- shield to reduce neutron or gamma radiation fluence
- support - structural, functional, or both - to maintain system functions

2.3.1.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.2, UFSAR Section 3.2.2 for Unit 1, and UFSAR Section 3.9N.5 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.1.2.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

On the basis of its review, the staff concludes that the applicant has adequately identified the RV internals 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) and; therefore, is acceptable.

2.3.1.3 Reactor Coolant System

2.3.1.3.1 Summary of Technical Information in the Application

In LRA Section 2.3.1.3, the applicant described the RCS, which transfers heat from the reactor core to the steam generators, the steam from which, drives the turbine generator. The RCS consists of three similar heat-transfer loops connected in parallel to the RV. Each loop has an identical reactor coolant pump (RCP), inlet and outlet loop isolation valves, a steam generator, and piping to various auxiliary or safety systems. The system also has a pressurizer, connecting piping, pressurizer safety and relief valves, and pressurizer relief tank, all of which is necessary for operational pressure control.

Borated demineralized water circulates in the system as a neutron moderator and reflector, as a solvent for chemical shim control in the reactor core, and as a heat-transfer medium.

During normal operation, coolant exiting the core passes through tubes in the steam generator for heat removal by cooler secondary system water, which heats sufficiently to form a steam-water mixture. After leaving the steam generator, the reactor coolant flows into the RCP, discharges through a nozzle on the side of the pump, and enters the cold leg inlet nozzles of the RV to begin the thermal cycle again.

The pressurizer and pressure relief subsystem is connected to the RCS by a surge line on the loop "C" hot leg to accommodate reactor coolant volume changes due to temperature changes. The pressurizer and pressure relief subsystem maintains RCS pressure by electric heaters and prevents over-pressurization by water spray into the steam to condense it. RCS pressure also is maintained by actuation of power-operated relief valves and safety valves. The pressurizer has two spray lines, one from each of two separate cold leg sources, which sprays the pressurizer steam volume with reactor coolant to prevent pressure increases beyond the control setpoint.

Unit 1 also has a reactor coolant gas vent system (an RCS subsystem) designed to vent gases from the RV head or pressurizer steam space during post-accident situations, if large quantities of non-condensable gases collect in these high points. This system provides a vent path to the pressurizer relief tank or direct venting to containment atmosphere and also may be an alternate letdown path to support post-fire safe-shutdown. Unit 2 has a RV head vent system (an RCS subsystem for license renewal evaluations) that removes noncondensable gases for additional RCS letdown capability.

The RCS system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the RCS potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the RCS performs functions that support fire protection, SBO, and EQ.

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

- bolting
- flexible hose (Unit 2 only)
- heat exchanger (Unit 1 only)
- hydraulic isolator
- orifice
- piping
- pressurizer
- pressurizer relief tank
- reactor coolant pump
- steam generator
- thermal sleeve
- tubing
- valve body

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

- control of flow distribution or direction
- restriction for flow rate limit or pressure difference
- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- support - structural, functional, or both - to maintain system functions
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.1.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.3, UFSAR Section 4.2 for Unit 1, and UFSAR Section 5.1 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.
During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.1.3.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the RCS 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) and; therefore, is acceptable.

2.3.2 Engineered Safety Features

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

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

- 2.3.2.1 containment depressurization system
- 2.3.2.2 residual heat removal system
- 2.3.2.3 safety injection system

The staff's findings on review of LRA Sections 2.3.2.1 – 2.3.2.3 are in SER Sections 2.3.2.1 – 2.3.2.3, respectively.

2.3.2.1 Containment Depressurization System

2.3.2.1.1 Summary of Technical Information in the Application

In LRA Section 2.3.2.1, the applicant described the containment depressurization system, which cools and depressurizes the containment and which can reduce and maintain containment pressure for an extended period of time after a DBA. The system also removes fission products from the containment environment following a primary system break.

The containment depressurization system consists of two subsystems; namely, the quench spray system and the recirculation spray system.

The quench spray system draws cold water from the refueling water storage tank (RWST), chemically treats the water, and sprays the containment. The system consists of two separate, parallel, 100-percent capacity trains, each with a quench spray pump discharging to spray headers located near the top of the reactor containment, piping, and valves. Sodium hydroxide solution added to the quench spray from the chemical addition tank improves removal of radioactive iodine from the containment atmosphere and controls containment sump pH.

The recirculation spray system for long-term cooling consists of four 50-percent capacity pumps which recirculate water from the containment sump through heat exchangers to spray containment after a containment isolation Phase B signal and low RWST level, which allows the containment sump to be filled by the quench spray system and primary plant leakage, makes adequate net positive suction head available for the pumps.

The water from the sump recirculates through recirculation spray heat exchangers for cooling by the river water (Unit 1) or service water (Unit 2) system. The cooled water then sprays the containment and the cycle repeats itself for an extended period.

The Unit 2 recirculation spray system also supplies water from the containment sump to the RCS and to the safety injection system (SIS) during the recirculation phase. The Unit 1 recirculation spray pumps can supply backup to the suction of the charging pumps in a failure of the low-head safety injection pumps. LRA Section 2.4.22 evaluates the containment sump as part of the reactor containment building.

The containment depressurization system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the containment depressurization system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the containment depressurization system performs functions that support fire protection, SBO, and EQ.

LRA Table 2.3.2-1 identifies containment depressurization system component types within the scope of license renewal and subject to an AMR:

- bolting
- flexible hose
- heat exchanger
- orifice
- piping
- pump casing
- spray nozzle
- strainer body
- strainer element
- tank
- tubing
- valve body

The intended functions of the containment depressurization system component types within the scope of license renewal include:

- control of flow distribution or direction
- filtration
- restriction for flow rate limit or pressure difference

- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.2.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.1, UFSAR Section 6.4 for Unit 1, UFSAR Section 6.2.2 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.2.1.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

On the basis of its review, the staff concludes that the applicant has adequately identified the containment depressurization system 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) and; therefore, is acceptable.

2.3.2.2 Residual Heat Removal System

2.3.2.2.1 Summary of Technical Information in the Application

In LRA Section 2.3.2.2, the applicant described the RHR system, which transfers heat from the RCS to the primary plant component cooling water system (CWS), to reduce the reactor coolant temperature to the cold shutdown level, at a controlled rate during normal plant cooldown, and maintains this temperature until the plant starts up. The system also transfers refueling water from the refueling cavity and transfer canal to the RWST at the end of refueling operations.

The RHR system consists of two redundant subsystems, each with one pump and one heat exchanger, piping, and valves. During system operation, reactor coolant pumped from an RCS hot leg through the RHR heat exchangers (for cooling by primary plant component cooling water) returns to RCS cold leg connections via the SIS accumulator discharge piping.

The RHR system contains safety-related components relied upon to remain functional during and following DBEs.

The failure of nonsafety-related SSCs in the RHR system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the RHR system performs functions that support fire protection (Unit 2 only) and EQ.

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

- bolting
- flexible hose
- heat exchanger
- orifice
- piping
- pump casing
- tubing
- valve body

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

- restriction for flow rate limit or pressure difference
- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.2.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.2, UFSAR Section 9.3 for Unit 1, and UFSAR Section 5.4.7 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.2.2.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the RHR system 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) and; therefore, is acceptable.

2.3.2.3 Safety Injection System

2.3.2.3.1 Summary of Technical Information in the Application

In LRA Section 2.3.2.3, the applicant described the safety-related SIS, which provides emergency cooling to the reactor core and which consists primarily of pumps, tanks, valves, piping, and other components.
The SIS is described in two phases; namely, injection and recirculation. The injection phase provides emergency core cooling and additional negative reactivity immediately following actuation. The recirculation phase provides long-term post-accident cooling by recirculating water from the containment sump.

The principal components during the injection phase are accumulators, the charging/high-head safety injection pumps, and the low-head safety injection pumps. The accumulators are passive components consisting of tanks containing borated water with nitrogen gas overpressure. Each accumulator is connected to an RCS cold leg through check valves. During plant operation, RCS pressure is much higher than that in the accumulators, so the check valves remain closed. During an accident, the check valves open and the water in the accumulators flows into the RCS for rapid core flooding for large breaks. The charging/high-head safety injection pumps perform charging functions during normal plant operations. The safety injection function of these pumps is described here, but the pumps are evaluated for license renewal with the chemical and volume control system (CVCS). On a safety injection signal, these pumps provide high-pressure injection and add negative reactivity to the core. The safety injection signal diverts the suction of the high-head safety injection pumps from the volume control tank (VCT) to the RWST. The low-head safety injection pumps supply a high volume of water at low pressures. For large breaks, the system depressurizes the RCS and rapidly voids it of coolant. In this situation, the low-head safety injection pumps and the accumulators provide the high flow rate required to recover the exposed fuel quickly and limit possible core damage.

For Unit 1, when the transfer to recirculation signal is generated the low-head safety injection pump suction valves from the containment sump open. The suction of the charging/high head safety injection pumps shifts automatically from the RWST to the discharge header of the low-head safety injection pumps. The suctions of the low-head safety injection pumps and charging/high head safety injection pumps from the RWST close. This alignment recirculates water from the containment sump back to the RCS. If the low-head safety injection pumps fail during recirculation, the outside recirculation spray pumps can supply suction to the charging/high head safety injection pumps by manual valve alignment.

For Unit 2, upon transfer to recirculation mode, the recirculation spray pumps recycle the containment sump water back to the RCS, discharging through the low-head safety injection headers to the high-head safety injection pumps. The high-head safety injection pumps then pump water to the loops.

The SIS contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the SIS potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the SIS performs functions that support fire protection and EQ.

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

- bolting
- flexible hose
- heat exchanger
- orifice
- piping
- pump casing
- tank
- tubing
- valve body

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

- restriction for flow rate limit or pressure difference
- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.2.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.3 and UFSAR Section 6.3 for Units 1 and 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.2.3.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has adequately identified the SIS 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) and; therefore, is acceptable.

2.3.3 Auxiliary Systems

In LRA Section 2.3.3, the applicant identified 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:

- 2.3.3.1 Area Ventilation Systems – Control Areas
- 2.3.3.2 Area Ventilation Systems – Plant Areas
- 2.3.3.3 Boron Recovery and Primary Grade Water System
- 2.3.3.4 Building and Yards Drain System
- 2.3.3.5 Chemical and Volume Control System
- 2.3.3.6 Chilled Water System
- 2.3.3.7 Compressed Air System
- 2.3.3.8 Containment System
- 2.3.3.9 Containment Vacuum and Leak Monitoring System
- 2.3.3.10 Domestic Water System
- 2.3.3.11 Emergency Diesel Generators and Air Intake and Exhaust System
- 2.3.3.12 Emergency Diesel Generators - Air Start System
- 2.3.3.13 Emergency Diesel Generators – Crankcase Vacuum System
- 2.3.3.14 Emergency Diesel Generators – Fuel Oil System
- 2.3.3.15 Emergency Diesel Generators – Lube Oil System
- 2.3.3.16 Emergency Diesel Generators – Water Cooling System
- 2.3.3.17 Emergency Response Facility Substation System (common)
- 2.3.3.18 Fire Protection System
- 2.3.3.19 Fuel Pool Cooling and Purification System
- 2.3.3.20 Gaseous Waste Disposal System
- 2.3.3.21 Liquid Waste Disposal System
- 2.3.3.22 Post-Accident Sample System
- 2.3.3.23 Post-Design Basis Accident Hydrogen Control System
- 2.3.3.24 Primary Component and Neutron Shield Tank Cooling Water System
- 2.3.3.25 Radiation Monitoring System
- 2.3.3.26 Reactor Plant Sample System
- 2.3.3.27 Reactor Plant Vents and Drains System
- 2.3.3.28 River Water System (Unit 1 only)
- 2.3.3.29 Security Diesel System (common)
- 2.3.3.30 Service Water System (Unit 2 only)
- 2.3.3.31 Solid Waste Disposal System
- 2.3.3.32 Supplementary Leak Collection and Release System

The staff's evaluation of the following LRA Sections did not require additional information:

- 2.3.3.6 Chilled Water System
- 2.3.3.10 Domestic Water System
- 2.3.3.11 Emergency Diesel Generators and Air Intake and Exhaust System
- 2.3.3.13 Emergency Diesel Generators – Crankcase Vacuum System
- 2.3.3.15 Emergency Diesel Generators – Lube Oil System
- 2.3.3.20 Gaseous Waste Disposal System
- 2.3.3.24 Primary Component and Neutron Shield Tank Cooling Water System
- 2.3.3.28 River Water System (Unit 1 only)

The staff's findings of these above mentioned systems were discussed and dispositioned in SER Section 2.3. The remaining sections requiring additional information to complete the review of the applicant's scoping and screening results are discussed below.

2.3.3.1 Area Ventilation Systems - Control Areas

2.3.3.1.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.1, the applicant described the area ventilation systems - control areas, which cool, heat, ventilate, filter, pressurize, control humidity in, and remove smoke from the MCR area (common to Units 1 and 2) and other control building areas (Unit 2). Although the control boards are functionally and physically separate, Units 1 and 2 share a common control room. The control room areas of both units are open to each other and, therefore, within the same pressure boundary. The units share the emergency control room pressurization systems for use during accidents. Each unit has separate cooling and pressurization subsystems. The control area ventilation system has two separate control room cooling and ventilation systems at each unit with redundant air handling units, refrigeration condensing units, river water (Unit 1) or service water (Unit 2) cooling coils, temperature control air compressors and controls (Unit 1), fans, ductwork, and dampers.

In an accident, the control room emergency ventilation system pressurization system fans pressurize the control room with filtered air while the normal ventilation systems continue to operate in the 100-percent recirculation mode. Three control room emergency ventilation system subsystems serve the common control room. Any one of the three can pressurize the entire control room. Two are powered from Train A and Train B of Unit 2, respectively, the third is powered from either Train A or Train B of Unit 1.

The two control room emergency ventilation system subsystems powered from Unit 2 are fully automatic. Either of these subsystems can pressurize the control room with no operator actions. The subsystem powered from Unit 1 is not fully automatic. Its fan control switches are not maintained in the auto start position, and manual damper alignment is required. The Unit 1 subsystem is not credited by Unit 2.

Unit 2 has a separate control building air-conditioning subsystem that ventilates the control building external to the control room. The intake and exhaust fans and cooling coils for this subsystem are located in the equipment room of the auxiliary building. Self-contained breathing apparatus units and sufficient reserve air cylinders are available to support the minimum control room shift composition for at least five hours. Air cylinders from offsite locations may extend capacity beyond five hours. At Unit 2, miscellaneous backdraft dampers protect against over-pressurization following a carbon dioxide (CO_2) actuation from the FPS.

The area ventilation systems - control areas contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the area ventilation systems - control areas potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the area ventilation systems - control areas performs functions that support fire protection and SBO.

LRA Table 2.3.3-1 identifies area ventilation systems - control areas component types within the scope of license renewal and subject to an AMR:

- air dryer
- bolting
- damper housing
- duct
- fan housing
- filter housing
- flexible connection
- heat exchanger
- heater housing
- isokinetic nozzle
- moisture separator
- piping
- tank
- tubing
- valve body

The intended functions of the area ventilation systems - control areas component types within the scope of license renewal include:

- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers).
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.1, UFSAR Section 9.13.4 for Unit 1, and UFSAR Section 9.4.1 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.3.1.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the area ventilation systems - control areas 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) and; therefore, is acceptable.

2.3.3.2 Area Ventilation Systems - Plant Areas

2.3.3.2.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.2, the applicant described the area ventilation systems - plant areas, which ventilates and controls temperatures for plant areas other than the control room. Portions of some of these systems are safety-related. The systems primarily consist of air conditioning units, ducts, fans, filters, heat exchangers, piping, valves, dampers, controls, and instrumentation. Various systems ventilate areas or components as described in this section.

Each area serviced by this system typically has an air-handling unit which recirculates air to maintain the design condition temperature. The air-handling unit has cooling coils (and heating coils in some applications) that condition the air drawn through it. Chilled water (and hot water where applicable) systems supply the unit coils at Unit 1. Unit 2 systems use chilled water or service water as a cooling medium, with some units also using hot water heating coils. Some Unit 2 areas include condenser-type air conditioning units. The area ventilation systems-cooling subsystems cool the following areas:

- Unit 1 Main Steam Valve Area
- Unit 1 Safeguards Area
- Unit 1 Cable Vault Area
- Unit 1 Pipe Tunnel Area
- Unit 1 Fuel Building
- Unit 2 Main Steam Valve Area
- Unit 2 North Safeguards Area
- Unit 2 South Safeguards Area
- Unit 2 Cable Vault and Rod Control Area
- Unit 2 Pipe Tunnel Area
- Unit 2 Fuel Building
- Unit 2 Decontamination Building
- Unit 2 Motor Control Centers
- Unit 2 Alternate Shutdown Panel

Containment Air Recirculation Cooling. Bulk air cooling of the containment is accomplished by air recirculation cooling systems, with the recirculated air normally cooled by chilled water. Unit 1 can use river water and Unit 2 service water as a backup cooling medium. Cooled air discharges into common ductwork for the ventilated spaces.

Air leaving the ventilated spaces recirculates back to the supply fans via the annular space between the crane wall and containment outside wall.

Containment Iodine Filtration (called the containment atmosphere filtration at Unit 2). Use of the filtration system within the containment is at the discretion of the plant operator. The system is not credited for any safety-related function or regulated event.

Containment Purge Exhaust and Supply. During shutdown periods, containment purging ventilation is accomplished by an exhaust and supply system, which also functions as a heating and ventilation system during periods of maintenance. The purge system exhaust duct is aligned with the supplementary leak collection and release system. Ductwork for this function is evaluated in that system. Containment purge includes safety-related containment penetrations (Unit 2) but otherwise is not credited for any safety-related function or regulated event.

Control Rod Drive Mechanism Shroud Cooling. Cooling of the control rod drive mechanism shroud is by containment ambient air drawn through the shroud and ductwork to fans that discharge through component cooling water coil banks before returning the air to containment. Shroud cooling is not credited for any safety-related function or regulated event.

The Unit 1 auxiliary building ventilation system is not credited for any safety-related function or regulated event. The supplementary leak collection and release system performs the credited ventilation functions for the Unit 1 auxiliary building.

Unit 2 auxiliary building air handling units have preheat coils and reheat coils that use hot water as the heating medium, while cooling coils use chilled water as the cooling medium, and motor-driven fans. Ductwork supplies air supply to all levels. The system is designed on a once-through basis, except for some air recirculated from the auxiliary building equipment room. The emergency exhaust fan system, which consists of two axial flow exhaust fans, ductwork, and dampers, ventilates the charging pump cubicles and component cooling water pumps general area, if normal ventilation fails. The two filter exhaust fans of the supplementary leak collection and release system exhaust the air at a rate higher than the supply rate to maintain the buildings under a negative pressure.

Switchgear Ventilation. Air exhausted from switchgear areas by the switchgear exhaust fan passes in ducts through an air filter, then a bank of six chilled-water cooling coils, then to the suction side of the switchgear supply fan for distribution to the switchgear, rod control room, cable tray mezzanine, and battery rooms.

A closed chilled-water system cools the cooling coils. Chilled water pumps circulate the chilled water to the switchgear ventilation system chillers. The river water system supplies cooling water for the chillers.

Various Shops and Office Areas. Air-handling units supply a mixture of outdoor and recirculated conditioned air exhausted from the areas by return air fans. A portion of the exhaust goes to the atmosphere and the remainder returns to the air-handling units. Most areas are ventilated by roof, wall, or ducted fans that supply, exhaust, or combine these functions. Descriptions follow for some specific areas with unique system features.

Unit 1 Service Building. In addition to the switchgear cooling system, one of two redundant continuously-running emergency switchgear and battery room exhaust fans removes heated air in emergency switchgear. In a loss of offsite power and loss of normal switchgear supply fan, one of two such redundant fans starts to supply outside air for heat removal from the emergency switchgear and battery rooms. These fans are safety-related.

Unit 2 Emergency Switchgear Area. The emergency switchgear area has two supply and two exhaust fans to remove heat. Both Train A fans and both Train B fans operate together. Either pair of fans handles all ventilation requirements, regulating temperature by modulating outdoor air, return air, and exhaust air dampers. These fans are safety-related.

Intake Structure. A Unit 1 fan supplies each pump cubicle. An additional fan is in the cubicle for the motor-driven fire pump. Each cubicle for a Unit 2 service water pump also has a Unit 2 fan. These fans supply a mixture of outdoor air and recirculated air to the cubicles. Outdoor air supplied to the four cubicles exhausts through vents in the upper Section of the cubicle to the building interior and to the atmosphere through exhaust roof hoods.

Unit 1 Diesel Generator Building. Each of the two diesel generator rooms has a ceiling-mounted propeller exhaust fan, which discharges room air outdoors to dissipate excess heat from equipment. Operation of either fan automatically opens its discharge damper and the outdoor air intake double damper in that diesel generator room. Starting of either diesel generator engine also opens its outdoor air intake double damper regardless of exhaust fan operation. At Unit 1, this outdoor air intake double damper supplies combustion air to and the diesel draws it from the room. The Unit 2 diesels, however, draw combustion air directly from outside.

The area ventilation systems - plant areas contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the area ventilation systems - plant areas potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the area ventilation systems - plant areas performs functions that support fire protection, SBO, and EQ.

LRA Table 2.3.3-2 identifies area ventilation systems - plant areas component types within the scope of license renewal and subject to an AMR:

- bolting
- damper housing
- drip pan
- duct
- fan housing
- filter housing
- flexible connection
- flexible hose
- heat exchanger (channel, plenum, shell, tube)
- isokinetic nozzle
- orifice
- piping
- piping (used as duct)

- valve body

The intended functions of the area ventilation systems - plant areas component types within the scope of license renewal include:

- restriction for flow rate limit or pressure difference
- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.2, UFSAR Sections 9.13.2, 9.13.5, and 9.13.6 for Unit 1 and UFSAR Sections 9.4.3 and 9.4.6 - 9.4.12 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

In reviewing LRA Section 2.3.3.2, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. Therefore, the staff issued RAIs concerning specific issues to determine whether the applicant has properly applied the scoping criteria pursuant to 10 CFR 54.4(a) and the screening criteria in accordance with 10 CFR 54.21(a) (1). The following paragraphs describe the staff's RAIs and the applicant's related responses.

In LRA drawing 1-44B-1, the staff noted that at coordinates C-6, the applicant identified valves VS-D-4-1 1A and VS-D-4-1 1B as receiving a containment isolation phase B signal.

This seems to indicate that these valves are used as an isolation barrier following a containment isolation phase B signal. The applicant has indicated on LR Drawing 1-44B-1 that these valves are within the scope of license renewal for fire protection only.

In RAI 2.3.3.2-01, dated March 3, 2008, the staff requested that the applicant explain why these valves and associated duct between the valves and from the valves to the penetration are not within the scope of license renewal as a pressure boundary or leakage barrier.

In response to RAI 2.3.3.2-01, dated March 31, 2008, that applicant stated that the notation “valves VS-D-4-1 1A and VS-D-4-1 1B are in-scope for fire protection only,” was in error. Valves VS-D-4-1 1A and VS-D-4-1 1B are safety-related and provide an isolation function. However, some ductwork associated with these valves also should have been included in-scope.

The applicant updated the LRA to add the required ductwork associated with valves VS-D-4-1 1A and VS-D-4-1 1B as within the scope of license renewal for structural support of safety-related valves, pursuant to 10 CFR 54.4(a) (2).

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.3-01 acceptable because the applicant has verified that the notation on LR Drawing 1-44B-1 was in error and has updated the LRA to add the required ductwork associated with valves VS-D-4-1 1A and VS-D-4-1 1B as within the scope of license renewal for structural support of safety-related valves. Therefore, the staff’s concern described in RAI 2.3.3.2-01 is resolved.

In LRA drawing 2-44B-3, the staff noted that at coordinates C-3, the applicant has identified a direct expansion cooling unit (2HVP-ACUS301) as having two pipe connections; namely, a capped line and a ¾-inch hose connection.

In RAI 2.3.3.2-02, dated March 3, 2008, the staff requested that the applicant explain whether there was a condensate drain for the cooling unit and if so, whether it is within the scope of license renewal for leakage pursuant to 10 CFR 54.4(a)(2).

In its response to RAI 2.3.3.2-02, dated March 31, 2008, the applicant stated that 2HVP-ACUS301 was locally verified to have a condensate drain line. The drain line corresponds to the ¾ - inch line with a hose connection shown on LR drawing 2-44B-3. There is no permanent drain piping beyond the hose connection. The air handling unit is classified as safety-related both on the ventilation (air) side and on the cooling (Freon) side; therefore, the condensate drain line has the same quality classification, and is highlighted in red (safety-related) on LR drawing 2-44B-3. Since the drain line is considered to be safety-related, it was not assigned a nonsafety-related function pursuant to 10 CFR 54.4(a) (2).

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.2-02 acceptable because the applicant has confirmed that the direct expansion cooling unit (2HVP-ACUS301) has a condensate drain which is within the scope of license renewal. Therefore, the staff’s concern described in RAI 2.3.3.2-02 is resolved.

2.3.3.2.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff’s review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the area ventilation systems - plant areas 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) and; therefore, is acceptable.

2.3.3.3 Boron Recovery and Primary Grade Water System

2.3.3.3.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.3, the applicant described the boron recovery and primary grade water system, which supplies makeup water to the RCS and processes reactor coolant letdown and liquid collected in the primary drains transfer tanks. The primarily nonsafety-related system consists of pumps, tanks, heat exchangers, degasifiers, evaporators, piping, valves, and controls. Degasifiers reduce the concentrations of dissolved and entrained gases in the primary coolant. This recovered gas then discharges to the gaseous waste system for processing. Degasified liquid may be evaporated to extract the boric acid water and collect the condensed primary grade water for re-use. Primary grade water storage is located at Unit 1 in two tanks that supply both units for various uses in the reactor plant.

The boron recovery and primary grade water system contains safety-related components relied upon to remain functional during and following DBEs (Unit 2 only). The failure of nonsafety-related SSCs in the boron recovery and primary grade water system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the boron recovery and primary grade water system performs functions that support EQ (Unit 2 only).

LRA Table 2.3.3-3 identifies boron recovery and primary grade water system component types within the scope of license renewal and subject to an AMR:

- bolting
- expansion joint (Unit 1 only)
- filter housing
- flexible hose
- heat exchanger (shell and channel)
- heat exchanger (tube/tubesheet) (Unit 2 only)
- orifice
- piping
- pump casing
- sight glass (Unit 1 only)
- strainer body
- tank
- tubing
- valve body

The intended functions of the boron recovery and primary grade water system component types within the scope of license renewal include:

- restriction for flow rate limit or pressure difference (Unit 2 only)
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention (Unit 2 only)

- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.3, UFSAR Section 9.2 for Unit 1, UFSAR Sections 9.2.8 and 9.3.4.6 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.3.3.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the boron recovery and primary grade water system 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) and; therefore, is acceptable.

2.3.3.4 Building and Yard Drains System

2.3.3.4.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.4, the applicant described the nonsafety-related building and yard drains system, which drains normal nonradioactive leakage, leakage due to maintenance, precipitation, and sanitary drains. The system is not credited for any safety-related function or regulated event. The building and yard drains system has four similar subsystems at Units 1 and 2:

- Floor drains system, which collects and disposes of internal drainage from buildings
- Oily drains system, which collects drainage that may include equipment oil leakage. This subsystem has oil separators that remove oil from the drainage prior to discharge of the waste water
- Sanitary drains system, which handles sewage from plumbing fixtures and directs drainage to the sewage treatment systems
- Roof and yard drains system, which directs drainage to the storm sewers

Additionally, Unit 2 has a fifth subsystem; namely, the recirculation spray pump casing drains system. The drains in this system can be exposed to radioactive contamination. LRA Section 2.3.3.27 evaluates this subsystem in the reactor plant vents and drains system.

The failure of nonsafety-related SSCs in the building and yard drains system could potentially prevent the satisfactory accomplishment of a safety-related function. The building and yard drains system also performs functions that support fire protection (Unit 1 only).

LRA Table 2.3.3-4 identifies building and yard drains system component types within the scope of license renewal and subject to an AMR:

- bolting
- expansion joint
- flow controller
- oil interceptor
- piping
- pump casing
- sight glass
- tank
- valve body

The intended functions of the building and yard drains system component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.4 and UFSAR Sections 9.7.2 and 9.2.4, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.4, the staff identified areas in which additional information was necessary to complete its review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

On LRA drawing 1-41D-2, the staff noted that the applicant has highlighted piping and other components of the turbine and service building and yard drains system as being included within the scope of license renewal for spatial concerns, in accordance with 10 CFR 54.4(a)(2). However, the applicant did not highlight the vents and flanges associated with tank DA-TK-2, oil interceptor DA-SP-1, and flow controller. In RAI 2.3.3.4-1, dated April 17, 2008, the staff requested that the applicant justify the exclusion of the above mentioned components from the scope of license renewal.

In its response to RAI 2.3.3.4-1, dated May 19, 2008, the applicant stated that the identified equipment vent lines contain ambient air only and do not have the potential for spatial interaction with safety-related components. Therefore, in accordance with the guidance found in NEI 95-10, Appendix F, Paragraph 5.2.2.1, the vents are not within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-1 acceptable because the applicant has clarified that the vents contain air only and do not have any potential for spatial interaction with safety-related components. Therefore, the staff's concern described in RAI 2.3.3.4-1 is resolved.

2.3.3.4.3 Conclusion

The staff reviewed the LRA, RAI response, and the UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the concludes that the applicant has adequately identified the building and yard drains system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.5 Chemical and Volume Control System

2.3.3.5.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.5, the applicant described the safety-related CVCS, the primary support system for the RCS during all normal modes of plant operation. Charging and letdown flows maintain a programmed water level in the RCS pressurizer.

Reactor coolant letdown to the CVCS is from the RCS cold leg. The regenerative heat exchanger reduces letdown temperature. Restricting orifices then reduce letdown pressure. The nonregenerative heat exchanger further cools the letdown. A second pressure reduction occurs downstream from the nonregenerative heat exchanger. The letdown flow path then leads to demineralizers, a filter, and into the VCT. The charging pumps normally take suction from the VCT and return the purified reactor coolant to the RCS cold leg via the charging system.

The bulk of the charging flow returns to the RCS through the regenerative heat exchanger, which increases its temperature. A parallel charging flow path, with a control valve, extends from the regenerative heat exchanger outlet to the pressurizer spray line and supplies auxiliary spray to the vapor space of the pressurizer.

The system directs a portion of the charging flow to the RCP seals via a seal water injection filter and introduces high-pressure injection water to the RCPs through a connection on the thermal barrier flange. The injection water lubricates both the radial bearing and the seals. The system also stores boric acid for reactivity control and makeup. Additionally, the centrifugal charging pumps serve as the high-head safety injection pumps in the emergency core cooling system.

The CVCS contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the CVCS potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the CVCS performs functions that support fire protection, SBO, and EQ.
LRA Table 2.3.3-5 identifies CVCS component types within the scope of license renewal and subject to an AMR:

- blender body
- bolting
- demineralizer
- filter housing
- flexible hose
- gear box
- heat exchanger
- orifice
- piping
- pump casing
- sight glass
- sparger body
- strainer body
- tank
- tubing
- valve body

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

- restriction for flow rate limit or pressure difference
- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.5, UFSAR Sections 6.3.2 and 9.1 for Unit 1, and UFSAR Sections 6.3.2 and 9.3.4 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.3.5.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the CVCS 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) and; therefore, is acceptable.

2.3.3.6 Chilled Water System

2.3.3.6.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.6, the applicant described the nonsafety-related chilled water system, which includes safety-related containment penetration piping and instrumentation, an auxiliary system that cools various plant components. The system consists of three chillers at each unit. Booster pumps supply river water (Unit 1) or service water (Unit 2) to the condensers. Chilled water circulation pumps circulate chilled water through the chillers and the various cooling loads. Each chiller has its own circulation pump. The system delivers water at 45° F to various station process and ventilation loads. If the chilled water system is unavailable, the system can supply river water (Unit 1) or service water (Unit 2) as backup cooling water to the containment air recirculation cooling coils.

The chilled water system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the chilled water system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the chilled water system performs functions that support EQ.

LRA Table 2.3.3-6 identifies chilled water system component types within the scope of license renewal and subject to an AMR:

- bolting
- heat exchanger
- orifice
- piping
- pump casing
- sight glass
- strainer body
- tank
- tubing
- valve body

The intended functions of the chilled water system component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.6.2 Staff Evaluation

The staff performed a detailed Tier 2 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For staff evaluation of this system, see Safety Evaluation Report (SER) Section 2.3.

2.3.3.6.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.3.7 Compressed Air System

2.3.3.7.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.7, the applicant described the nonsafety-related compressed air system (CAS), an auxiliary system that provides adequate compressed air capacity of suitable quality and pressure for normal station service and instrumentation, and which includes safety-related containment penetration piping and instrumentation and safety-related components in the intake structure used to inflate flood door seals,

The CAS consists of several subsystems:

- Station air system
- Instrument air system
- Containment instrument air system
- Condensate polishing air system (Unit 2)
- Intake structure and Unit 1 cooling tower pump house air systems

Two air compressors supply the station air system. Two station air receiver tanks and the necessary pipes and valves deliver air to numerous plant locations for maintenance personnel use. This system also supplies raw air to the instrument air system and can supply station air inside the containment through a pipe penetration.

The instrument air system has filters, air dryers, a receiver tank, and the necessary pipes and valves to deliver this air to numerous air loads. This system also has bypass filters for use during system upsets or dryer maintenance.

This system supplies clean, dry air to the station's air-operated components. At Unit 1, this system is the normal supply to the containment instrument air system. At Unit 2, the system backs up the supply to the containment instrument air system.

The station instrument air system supplies the Unit 1 containment instrument air system via an air-operated containment isolation trip valve. Rotary, water seal air compressors normally supply the Unit 2 containment instrument air system. A refrigerant-type air dryer dries the air. Two receiver tanks are in the system, one outside and the other inside the containment. This system supplies clean, dry air to the air-operated components in the containment.

The Unit 2 condensate polishing air system consists of an air compressor, a receiver tank, and the necessary pipes and valves. The condensate polishing air compressor is in use normally only when there is heavy air demand in the condensate polishing system. This system supplies raw compressed air to the condensate polishing system and backs up the air supply to the station air system.

In a loss of both station air compressors (and at Unit 2 the condensate polishing air compressor), a diesel-driven air compressor is available to supply air to the instrument air lines for operation of critical air-operated valves and controllers.

The intake structure and the Unit 1 cooling tower pump house both have an independent CAS to supply the loads in the respective building. Additionally, the intake structure has air tanks with sufficient capacity to inflate and maintain flood door seals at the required pressure for the duration of the probable maximum flood (PMF). These tanks, filled from compressed air or gas bottles, do not rely upon the system compressors.

Operation of the CAS for Unit 2 (*i.e.*, supplying compressed air) is credited for operation of some air-operated charging and letdown flow path valves, thermal barrier cooling, and RHR flow control during post-fire shutdown.

The supply of compressed air is not credited for any other license renewal intended function at Unit 2 nor is the supply of air from Unit 1 compressors credited, although Unit 1 credits the storage of compressed air or gas in accumulator tanks for operation of inflatable intake structure flood door seals. Additionally, both units have containment penetrations with a safety-related pressure boundary function.

The CAS contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the CAS potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the CAS performs functions that support fire protection, SBO (Unit 2 only), and EQ.

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

- air dryer
- bolting
- chemical injector
- filter housing
- flexible hose
- heat exchanger

- moisture separator
- orifice
- piping
- pump casing
- sight glass
- silencer
- strainer body
- tank
- trap body
- tubing
- valve body

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

- restriction for flow rate limit or pressure difference
- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.7 and UFSAR Sections 9.8 and 9.3.1, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.7, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff noted that on LRA drawing 2-34-2, the applicant has highlighted piping from the standby instrument air train that supplies backup containment instrument air to the following branch lines:

- A 1-inch branch line to valve 614 in the cable vault building that supplies downstream components in the containment penetrations cubicle
- A 1-inch branch line and a ¾-inch branch line in the auxiliary building that supply unspecified downstream components

Since the branch lines continue onto another drawing that was not included in the application, the staff was unable to confirm which components were within the scope of license renewal and subject to an AMR downstream of these continuation lines. In RAI 2.3.3.7-1, dated April 17, 2008, the staff requested that the applicant describe the components that are connected by the ¾-inch and two 1-inch compressed air branch lines and their intended function or provide a copy of the continuation drawings for these branch lines identifying the components that require inclusion within the scope of license renewal, as appropriate.

In its response and supplemental response to RAI 2.3.3.7-1, dated May 19, 2008 and July 24, 2008, respectively, the applicant stated that these branch lines supply control air to the CVCS charging flow control valve 2CHS-FCV122, the CVCS letdown backpressure control valve 2CHS-PCV145, and the CVCS letdown isolation valve 2CHS-AOV204. The applicant stated that these valves are relied on to achieve safe-shutdown following a fire in each specific area within the containment. The piping and valves in the supply lines to these valves, as well as the branch lines up to the first isolation valve, are within the scope of license renewal and are subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-1 acceptable because the applicant has identified the components downstream of the branch lines and the intended function of the instrument air to those components, and that the piping and valves are within scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.7-1 is resolved.

The staff noted that on LRA drawing 2-34-3, the applicant included part of a 3-inch containment instrument air loop header within the scope of license renewal, but indicated that other portions of the 3-inch containment instrument air loop header are not within the scope of license renewal. These out-of-scope piping segments contain downstream piping that is not isolable from the part of the loop header that is within the scope of license renewal. Should a loss of pressure occur from a break of this downstream 3-inch containment instrument air loop header, the entire 3-inch instrument air header, including the in-scope portion, would lose air pressure. The staff noted that in LRA Section 2.3.3.7, the applicant stated that the CAS provides compressed air to position air-operated valves that are required for post-fire safe-shutdown for fire protection in accordance with 10 CFR 54.4(a)(3).

In SRP-LR, page 2.1-8, the staff guidance for the review of scoping methodology to identify SSCs that are credited by regulated events, states in part, that "all SSCs that are relied upon in the plant's CLB (as defined in 10 CFR 54.3), plant-specific operating experience, industry-wide experience (as appropriate), and safety analyses or plant evaluations to perform a function that demonstrates compliance with NRC regulations identified under 10 CFR 54.4(a)(3), are required to be included within the scope of the rule."

On June 20, 2007, San Onofre Nuclear Generating Station Unit 2 experienced a loss of instrument air due to a failure of a joint in its 3-inch instrument air header, which resulted in a reactor trip. This event was reported in a letter regarding Docket No. 50-361, Licensee Event

Report Nos. 2007-001 and 2007-002, San Onofre Nuclear Generating Station, Unit 2, dated August 17, 2007. This event represents relevant industry operating experience of an instrument air header failure that would be applicable to the LRA for BVPS. In RAI 2.3.3.7-2, dated April 17, 2008, the staff requested that the applicant justify exclusion of the entire 3-inch containment instrument air loop header from within the scope of license renewal in accordance with 10 CFR 54.4(a)(3).

In its response to RAI 2.3.3.7-2, dated May 19, 2008, the applicant stated that they revised the LRA and associated LRA drawings to "include the remainder of the main air loop header and the branch air lines for the entire flowpath within the scope of license renewal up to and including the first isolation valve from the main flowpath."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-2 acceptable because the applicant has included the entire 3-inch main air loop header within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.3.7-2 is resolved.

In LRA drawings 2-34-1A and 2-34-2, the staff noted that the applicant did not highlight station service air compressors 2SAS-C21A and 2SAS-C21B, nor the station service air system piping, air receivers, and air dryer components that connect to the standby instrument air train header. The staff further noted that in LRA Section 2.3.3.7, the applicant stated that the Unit 2 CAS provides compressed air to position air-operated valves required for post-fire safe-shutdown in accordance with 10 CFR 54.4(a)(3). In UFSAR Section 9.5A.1.2.3.1.12 for Unit 2, the applicant stated that station air compressors (2SAS-C21A and 2SAS-C21B) direct air to the required components via a cross-connect to the containment instrument air header station to position several flow control, hand control, and air operated valves that are required for post-fire safe-shutdown.

In RAI 2.3.3.7-3, dated April 17, 2008, the staff requested that the applicant (a) provide an explanation of the apparent difference in the credited source of compressed air for post-fire safe-shutdown between the UFSAR and the application, and (b) justify the exclusion of the identified portions of station service air system piping and components on LRA drawings 2-34-2 and 2-34-1A from the scope of license renewal that are credited for post-fire safe-shutdown, in accordance with 10 CFR 54.4(a)(3).

In its response to RAI 2.3.3.7-3, dated May 19, 2008, the applicant stated that "FENOC no longer credits the station air compressors and associated equipment in achieving safe-shutdown at BVPS Unit 2." The applicant has identified that a change notice was approved to modify UFSAR Section 9.5A.1.2.3.1.12 to credit the diesel-driven standby instrument air compressor 21AS-C21 in lieu of the station air compressors.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-3 acceptable because the applicant has identified that a change notice modified the UFSAR to credit the diesel driven air compressor for safe-shutdown in lieu of the station service air compressors. Therefore, the staff's concern described in RAI 2.3.3.7-3 is resolved.

2.3.3.7.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff found instances where the applicant omitted systems and structures that should have been included within the scope of license renewal. The applicant has satisfactorily resolved the issues as discussed in the preceeding staff evaluation. The staff finds no further omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no further omissions. Based on its review, the staff finds that the applicant has adequately identified the CAS components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.8 Containment System

2.3.3.8.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.8, the applicant described the containment system, which maintains the containment pressure boundary. The system contains the mechanical components of the personnel airlock and the equipment hatch emergency airlock that includes piping, valves and instruments for airlock pressure instrumentation, equalization, or testing and actuators, pumps, tanks, piping components, and valves of the airlock door hydraulic operating mechanisms. The system has safety-related components. LRA Section 2.4.22, evaluates all other containment structure components as structural.

The containment system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the containment system potentially could prevent the satisfactory accomplishment of a safety-related function.

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

- actuator housing
- bolting
- flexible hose
- piping
- pump casing
- sight glass
- strainer body
- tank
- tubing
- valve body

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

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention

- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.8.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.8, UFSAR Section 5.2.4.8 for Unit 1, and UFSAR Section 3.8.1.1.3.2 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff reviewed LRA Section 2.3.3.8 and identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The following paragraphs describe the staff's RAIs and the applicant's related responses.

In LRA drawing 2-47-1, at coordinates C-8/9, the staff noted that the applicant did not highlight the lines from panel 2PHS-EALI associated with the connections labeled *CNMT. BLKD. SHAFT "A" SEAL TEST CONN.,* and *CNMT. BLKD. SHAFT "B" SEAL TEST CONN.,* as being within the scope of license renewal, while the applicant highlighted the lines from the connections labeled *CTMT. BLKD. DOOR SEAL TEST CONN.,* and ATMOS. *BLKD. SHAFT "A" SEAL TEST CONN.,* as being in-scope. Both sets of lines appear to enter the hatch airlock volume.

In RAI 2.3.3.8-01.a, dated March 3, 2008, the staff requested that the applicant explain the difference in the scoping.

In its response to RAI 2.3.3.8-01.a, dated March 31, 2008, the applicant stated that the highlighting for the emergency airlock shaft seal test lines was incorrectly omitted. The applicant revised LRA drawing 2-47-1 to correctly depict all emergency airlock test lines as highlighted in red (in-scope). The applicant further stated that this change does not affect any LRA text or AMR table results.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.8-01.a acceptable because the applicant has corrected LRA drawing 2-47-1 to depict all emergency airlock test lines as within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.3.8-01.a is resolved.

In LRA drawing 2-47-1, the staff also noted that the test panel connection labels *ATMOS. BLKD. SHAFT "A" SEAL TEST CONN, ATMOS. BLKD. DOOR SEAL TEST CONN.,* and *ATMOS. BLKD. SHAFT "B" SEAL TEST CONN.,* do not appear to match the lines whose test connections they are closest to. In RAI 2.3.3.8-10.b, dated March 3, 2008, the staff requested that the applicant clarify this labeling arrangement.

In its response to RAI 2.3.3.8-01.b, dated March 31, 2008, the applicant stated that the emergency airlock test connection labels shown on LRA drawing 2-47-1 were incorrect and are correctly shown on revised LRA drawing 2-47-1.

The applicant further stated that as shown on the revised drawing, the test panel connection labels align with the lines closest to the test connections.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.8-01.b acceptable because the applicant has corrected LRA drawing 2-47-1 to reflect the test panel connection labels in alignment with the lines closest to the test connections. Therefore, the staff's concern described in RAI 2.3.3.8-01.b is resolved.

2.3.3.8.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the containment system 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) and; therefore, is acceptable.

2.3.3.9 Containment Vacuum and Leak Monitoring System

2.3.3.9.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.9, the applicant described the containment vacuum and leak monitoring system, which maintains subatmospheric pressure in the containment during normal operation and determines the leakage rate into or out of containment by and periodic tests. Portions of the containment vacuum and leakage monitoring system are safety-related. The containment vacuum and leakage monitoring system consists of ejectors, vacuum pumps, piping, valves, and instrumentation. The containment vacuum ejector uses auxiliary steam to remove air from the containment structure to create, prior to plant operation, a subatmospheric pressure maintained by the vacuum pumps. The discharges of the containment vacuum pumps combine and pass through a flow indicator and integrator to the gaseous waste disposal (GWD) system. A tap on the suction line of each pump also connects to the post-DBA HCS.

The system also has instrument piping for containment pressure measurement and provides the sample and return flowpath for the containment air particulate and gaseous activity radiation monitor evaluated in the radiation monitoring system (RMS). The containment vacuum pumps alternately sample the containment air when the activity monitor pump is out of service.

The containment vacuum and leak monitoring system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the containment vacuum and leak monitoring system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the containment vacuum and leak monitoring system performs functions that support EQ.

LRA Table 2.3.3-9 identifies containment vacuum and leak monitoring system component types within the scope of license renewal and subject to an AMR:

- bolting
- ejector
- flexible hose
- heater body
- moisture separator
- orifice
- piping
- pump casing
- strainer body
- trap body
- tubing
- valve body

The intended functions of the containment vacuum and leak monitoring system component types within the scope of license renewal include:

- restriction for flow rate limit or pressure difference
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.9.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.9, UFSAR Section 5.4.2 for Unit 1, and UFSAR Sections 6.2.4.2 and 9.5.10 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.3.9.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the containment vacuum and leak monitoring system 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) and; therefore, is acceptable.

2.3.3.10 Domestic Water System

2.3.3.10.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.10, the applicant described the nonsafety-related domestic water system that supplies softened water as required to various plant areas for sanitation, emergency showers, and eye wash stations. Domestic water also fills drain traps and can be an alternate supply of cooling to the Unit 2 station air compressors. The system, not credited for any safety-related function or regulated event, has piping components, valves, pumps, water softener (not used), tanks, and water heaters. The domestic water system supply is provided by the Midland water system. Prior to the Midland connection, the site processed and stored all of its required domestic water without a supply from any municipal system. The Midland system supply-pressure is satisfactory for all site needs; therefore, system portions that previously processed, stored, and pressurized domestic water are no longer in service and are isolated in the field. However, no domestic water system equipment or components were retired, but are available for use if needed.

The failure of nonsafety-related SSCs in the domestic water system could potentially prevent the satisfactory accomplishment of a safety-related function.

LRA Table 2.3.3-10 identifies domestic water system component types within the scope of license renewal and subject to an AMR:

- bolting
- heat exchanger
- level gage
- piping
- pump casing
- strainer body
- tank
- valve body
- water hammer arrestor

The intended function of the domestic water system component types within the scope of license renewal is to provide nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions.

2.3.3.10.2 Staff Evaluation

The staff performed a simplified Tier 1 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant’s scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.3.10.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.3.11 Emergency Diesel Generators and Air Intake and Exhaust System

2.3.3.11.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.11, the applicant described the emergency diesel generators and air intake and exhaust system. The EDG system for each unit consists of two safety-related engine-generator sets, each dedicated to an emergency train with all controls and support equipment required to start, run, sequence, and load the EDG, in the emergency mode, to meet the plant's operational requirements. Upon a loss of voltage to an emergency bus, the EDG starts automatically, energizes the bus, and then sequences on the emergency loads to the emergency bus. The EDG will carry the load up to its full load rating for up to seven days.

Each EDG also has controls to allow synchronization with the station's power supply and operation at full load to demonstrate operability. Each EDG has mechanical support equipment that can be grouped into six subsystems as described in the following sections. Each subsystem has safety-related subcomponents of the diesel generator.

(1) Emergency Diesel Generators and Air Intake and Exhaust System (System description follows this list)
(2) Emergency Diesel Generators—Air Start System (Section 2.3.3.12)
(3) Emergency Diesel Generators—Crankcase Vacuum System (Section 2.3.3.13)
(4) Emergency Diesel Generators—Fuel Oil System (Section 2.3.3.14)
(5) Emergency Diesel Generators—Lube Oil System (Section 2.3.3.15)
(6) Emergency Diesel Generators—Water Cooling System (Section 2.3.3.16)

The Unit 1 diesels draw combustion air from within the diesel generator building, while the Unit 2 diesels draw combustion air from outside the building such that it is separated from the exhaust to ensure that the air is not diluted or contaminated by exhaust products. A turbocharger supplies the volume of air needed for combustion and scavenging. The air from the blower increases in pressure and temperature. The air temperature decreases as it passes through aftercoolers, making cooled air of greater density, thus, increasing oxygen supply to the engine.

The diesels exhaust with silencers in protected enclosures located at the building roof level. Forced-air ventilation, with integral fans (blowers), cool the synchronous generators of the Unit 1 EDG engine-generator sets. Although the forced air from these fans/blowers is not combustion air, it is evaluated with the auxiliary system that supplies forced air to each EDG engine. Rotating blades attached internally to the generator rotors cool the synchronous generators of the Unit 2 EDG engine-generator sets. The blades draw air in through both end-cover screens, force air flow past the stator, and exhaust it through side vents. Although the forced air from these internal blades is not combustion air, it is evaluated with the auxiliary system that supplies forced air to each EDG engine.

The EDGs and air intake and exhaust system contains safety-related components relied upon to remain functional during and following DBEs. In addition, the emergency diesel generators and air intake and exhaust system performs functions that support fire protection and SBO.

LRA Table 2.3.3-11 identifies EDGs and air intake and exhaust system component types within the scope of license renewal and subject to an AMR:

- blower housing (Unit 1 only)
- bolting
- expansion joint
- filter housing
- flexible hose
- heat exchanger
- piping
- silencer
- tubing
- turbocharger housing
- valve body

The intended functions of the EDGs and air intake and exhaust system component types within the scope of license renewal include:

- heat transfer
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention

2.3.3.11.2 Staff Evaluation

The staff performed a detailed Tier 2 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For the staff evaluation of this system, see Safety Evaluation Report (SER) Section 2.3.

2.3.3.11.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.3.12 Emergency Diesel Generators - Air Start System

2.3.3.12.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.12, the applicant described the EDGs - air start system. Each emergency diesel has an air start system sized for five generator starts without outside power. There are two independent air start systems for each EDG, either of which can start the engine. The diesel air start systems consist of air compressors, coolers, dryers, separators, tanks, air motors (including the Unit 2 air start distributors), and the necessary piping, valves, fittings, and I&C systems. The Unit 1 air start system rotates the engine using air motors; the Unit 2 system, by porting starting air to the cylinders via a start-air distributor. The applicant references the distributor as a motor in this application. The Unit 2 air start system also has a skid-mounted air tank in the supply line to the servo fuel rack shutdown and fuel rack booster to ensure a source of air for positive fuel shutoff.

The EDGs - air start system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the EDGs - air start system potentially could prevent the satisfactory accomplishment of a safety-related function.

LRA Table 2.3.3-12 identifies emergency diesel generators - air start system component types within the scope of license renewal and subject to an AMR:

- air dryer (Unit 2 only)
- bolting
- filter housing
- flexible hose
- heat exchanger
- injector
- moisture separator
- motor casing
- orifice
- piping
- strainer body
- tank
- trap body
- tubing
- valve body

The intended functions of the EDGs - air start system component types within the scope of license renewal include:

- restriction for flow rate limit or pressure difference
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.12.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.12 and UFSAR Sections 8.5.2.3 and 9.5.6 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.12, the staff 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 LRA drawing 1-36-1 for the EDGs - air start system, the staff noted that the applicant highlighted strainers and filters as being within the scope of license renewal. The staff also noted on LRA drawing 2-36-3 for the EDGs - air start system, that the applicant highlighted strainers and filters as being within the scope of license renewal. Additionally, in LRA Table 2.3.3-12, the applicant identified component types "strainer body" and "filter housing" as within the scope of license renewal, for purposes of a pressure boundary intended function, pursuant to 10 CFR 54.4(a)(1).

NEI 95-10, Revision 6, Table 4.1-1, "Typical Passive Structure and Component Intended Functions", identifies that filtration is an intended function for the component type "filter." However, in LRA Table 2.3.3-12, the applicant did not identify component type "filter" with the intended function of filtration. In RAI 2.3.3.12-1, dated April 17, 2008, the staff requested that applicant justify the exclusion from LRA Table 2.3.3-12, the intended function "filtration" for the above mentioned component types, strainers and filters, in the EDGs – air start system.

In its response to RAI 2.3.3.12-1, dated May 19, 2008, the applicant stated:

> All filter elements, as well as strainer elements that are not specifically credited with a filtration function, were screened out as short-lived. The filter elements are periodically replaced, and the strainer elements are periodically cleaned and inspected, or replaced. These internal filter/strainer elements are not long-lived, and are not subject to an AMR in accordance with 10 CFR 54.21(a)(1)(i).

Based on its review, the staff finds the applicant's response to RAI 2.3.3.12-1 acceptable because the applicant has clarified that the filter and strainer elements in this system are periodically replaced: therefore, they are not long-lived or subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.12-1 is resolved.

In UFSAR Section 3.6B.1.3.3.1 for Unit 2, the staff noted the applicant's statement that for all high-energy lines outside containment, each postulated break type and orientation is investigated to determine whether the unrestrained whipping of severed pipe could impact and damage any safety components. In UFSAR Section 3.6B.1.1.1, the applicant defined high-energy piping systems as fluid systems that are either in operation or maintained pressurized under conditions where either or both of the following are met: a maximum operating temperature exceeding 200°F or pressure exceeding 275 psig.

The Unit 2 EDG air start system operates at pressures greater than 425 psig and contains fluids; therefore, this system meets the definition of a high-energy piping system. The staff further noted that on LRA drawing 2-36-3, the applicant did not highlight parts of the EDG air start system, indicating it is not within the scope of license renewal.

In RAI 2.3.3.12-2, dated April 17, 2008, the staff requested that the applicant justify the exclusion of the non-highlighted EDG air start piping from the scope of license renewal.

In its response to RAI 2.3.3.12-2, dated May 19, 2008, the applicant stated:

> The non-highlighted portion of nonsafety-related diesel generator air start piping is not within the scope of license renewal, because its failure would not prevent satisfactory accomplishment of any safety-related functions. This conclusion is documented within the BVPS CLB in the response to NRC Interrogatory 430.77, dated September 19, 1983, and approved by NRC in the SER for the BVPS Unit 2 FSAR (operating license stage), dated October 1985, and was provided in Amendment 8 of the FSAR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.12-2 acceptable because the applicant has clarified that the CLB justifies the reason for excluding the non-highlighted EDG air start piping from the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.3.12-2 is resolved.

2.3.3.12.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. Based on its review, the staff finds that the applicant has adequately identified the EDG air start system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.13 Emergency Diesel Generators - Crankcase Vacuum System

2.3.3.13.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.13, the applicant described the emergency diesel generators - crankcase vacuum system. The EDGs at Units 1 and 2 have a crankcase vacuum system to remove oil vapors from the EDGs during operation, but the systems function differently at each unit.

Each Unit 1 EDG has a lube oil separator mounted on the turbocharger housing. An ejector assembly mounted on the lube oil separator cover connects by a flanged tube to an eductor tube in the exhaust stack. During engine operation, air pressure from the discharge of the turbocharger compressor passes through the ejector assembly, creating a suction which draws up engine oil vapors through an internal screen element. Oil collects on the screen element and drains back into the engine. The remaining gaseous vapor discharges to the exhaust stack and vents to the atmosphere. The oil separator, eductor assembly, air pressure from the turbocharger compressor, and exhaust stack suction together form a functional crankcase vacuum system. The Unit 1 crankcase vacuum system has no moving parts and is not essential to the safe, reliable operation of the diesel engine, except in maintaining a pressure boundary for proper operation of the air intake and exhaust system.

The Unit 2 crankcase vacuum system has a crankcase vacuum pump, moisture (oil) separator, piping, and fittings. The crankcase vacuum system removes oil vapors from the diesel engine crankcase. The crankcase vacuum system is not essential to the safe, reliable operation of the diesel engine, but has safety-related instrumentation with tubing and valves.

The EDGs - crankcase vacuum system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the EDGs - crankcase vacuum system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Table 2.3.3-13 identifies EDGs - crankcase vacuum system component types within the scope of license renewal and subject to an AMR:

- bolting
- expansion joint
- flexible hose
- moisture separator
- piping
- tubing
- valve body

The intended functions of the EDGs - crankcase vacuum system component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention

2.3.3.13.2 Staff Evaluation

The staff performed a detailed Tier 2 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.3.13.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.3.14 Emergency Diesel Generators - Fuel Oil System

2.3.3.14.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.14, the applicant described the safety-related emergency diesel generators - fuel oil system, which stores fuel oil for the EDGs during normal operation and supplies fuel oil to the diesel generator fuel oil pumps. The fuel oil system consists of underground fuel oil storage tanks, transfer pumps, day tanks, engine-mounted fuel pumps and tanks, injectors, piping, and valves. The Unit 1 fuel oil inventory supports operation of one diesel generator for seven days. The Unit 2 system can support operation of both diesels for seven days.

The EDGs - fuel oil system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the emergency diesel generators - fuel oil system potentially could prevent the satisfactory accomplishment of a safety-related function.

LRA Table 2.3.3-14 identifies EDGs - fuel oil system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- flame arrestor
- flexible hose (Unit 2 only)
- orifice
- piping
- pump casing
- sight glass
- strainer body
- strainer element
- tank
- tubing
- valve body

The intended functions of the EDGs - fuel oil system component types within the scope of license renewal include:

- filtration
- restriction for flow rate limit or pressure difference
- prevention of fire spread by flame preclusion
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.14.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14 and UFSAR Sections 8.5.2.3 (Unit 1), 9.14.4.1 (Unit 1) and 9.5.4 (Unit 2), using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.14, the staff 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 LRA renewal drawing 1-36-2 for the EDGs - fuel oil system, the staff noted that the applicant did not highlight the *diesel generator fuel oil holding tank, EE-TK-6*. In UFSAR Section 9.14.6 for Unit 1, the applicant described that the contents of the holding tank are sampled prior to transferring oil to the diesel generator storage tanks. In RAI 2.3.3.14-1, dated April 17, 2008, the staff requested that the applicant justify the exclusion of the diesel generator fuel oil holding tank from the scope of license renewal.

In its response to RAI 2.3.3.14-1, dated May 19, 2008, the applicant stated:

> The Unit 1 diesel generator fuel oil holding tank EE-TK-6 is not safety-related, and is not credited for any license renewal function. Unit 1 UFSAR, Sections 8.5.2.3 and 9.14.4.1, specify that the required fuel oil inventory is provided by the 20,000 gal storage tanks. EE-TK-1A and EE-TK-1B, the diesel fuel storage tanks, are safety-related, and are labeled on license renewal drawing 1-36-2 as "20000 gal." If the holding tank (EE-TK-6) were to fail, or were found to contain fuel oil of inadequate quality, there would be no affect on the ability of the diesel generators to perform their intended function.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.14-1 acceptable because the applicant has clarified that the diesel generator fuel oil holding tank is not safety-related and is not credited for any license renewal intended function, including the required fuel oil inventory. Therefore, the staff's concern described in RAI 2.3.3.14-1 is resolved.

2.3.3.14.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. Based on its review, the staff finds that the applicant has adequately identified the EDG fuel oil system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.15 Emergency Diesel Generators - Lube Oil System

2.3.3.15.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.15, the applicant described the emergency diesel generators - lube oil system, which supplies essential lubrication to EDG components. The lube oil system for each engine has lube oil pumps, heat exchangers, piping components, and valves. Both units make provisions for keeping the lubricating oil warm during standby operation. When the Unit 1 engine shuts down, the lube oil cooler operates as a heater. Water heated by immersion heaters heats the oil in the lube oil cooler. The auxiliary oil system operates continuously and supplies warmed oil to the turbocharger and engine sump when the engine shuts down. The Unit 2 electric pumps operate continuously during standby to circulate oil through the electric keep-warm heater to other essential parts.

The EDGs - lube oil system contains safety-related components relied upon to remain functional during and following DBEs.

LRA Table 2.3.3-15 identifies EDGs - lube oil system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- flexible hose
- heat exchanger
- heater housing
- orifice
- piping
- pump casing
- sight glass
- strainer body
- strainer element
- tank
- tubing
- valve body

The intended functions of the emergency diesel generators - lube oil system component types within the scope of license renewal include:

- filtration
- restriction for flow rate limit or pressure difference
- heat transfer
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention

2.3.3.15.2 Staff Evaluation

The staff performed a detailed Tier 2 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.3.15.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.3.16 Emergency Diesel Generators - Water Cooling System

2.3.3.16.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.16, the applicant described the emergency diesel generators - water cooling system, which supplies water to cool diesel engine components. The system consists of circulating pumps, water temperature regulating valves, water expansion tanks, electric heaters, heat exchangers, piping components, valves, and I&C. The river water system (Unit 1) or the SWS (Unit 2) cools the EDG CWS heat exchangers.

The EDGs - water cooling system contains safety-related components relied upon to remain functional during and following DBEs.

LRA Table 2.3.3-16 identifies EDGs - water cooling system component types within the scope of license renewal and subject to an AMR:

- bolting
- flexible hose
- heat exchanger
- heater housing
- orifice
- piping
- pump casing
- sight glass
- tank
- tubing
- valve body

The intended functions of the EDGs - water cooling system component types within the scope of license renewal include:

- restriction for flow rate limit or pressure difference
- heat transfer
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention

2.3.3.16.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.16 and UFSAR Sections 8.5.2.3 for Unit 1 and 9.5.5 for Unit 2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.16, the staff 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 LRA drawings 2-36-4A and 2-36-4B for EDG 2EGS-EG2-1 and EDG 2EGS-EG2-2, respectively, the staff noted that for the EDG - water cooling system, the applicant indicated that cooling water is supplied to the turbo chargers.

In LRA Tables 2.3.3-11 and 2.3.3-16, the staff noted that the applicant listed components subject to an AMR for the EDGs - air intake and exhaust system, and the EDGs - water cooling system, respectively. Also, in LRA Table 2.3.3-11, the applicant included the component type "turbo charger housing." However, in LRA Table 2.3.3-16, the applicant did not include "turbo charger housing" as a component type.

In LRA Tables 3.3.2-11 and 3.3.2-16, the staff noted that the applicant identified the summary of aging management evaluations for the EDGs - air intake and exhaust system and the EDGs - water cooling system, respectively. Also, In LRA Table 3.3.2-11, the applicant identified the component type "turbo charger housing" with air as the environment. However, the applicant did not identify an environment of closed cooling water for the component type "turbo charger housing." In LRA Table 3.3.2-16, the applicant did not identify a component type "turbo charger housing."

In RAI 2.3.3.16-1, dated April 17, 2008, the staff requested that the applicant justify the exclusion of the component type "turbo charger housing" from LRA Tables 2.3.3-16 and 3.3.2-16, and the exclusion of the associated environment "closed cooling water" from LRA Tables 3.3.2-11 and 3.3.2-16.

In its response, dated May 19, 2008, the applicant explained that LRA Table 2.3.3-16 did not specifically include the component type "turbocharger housing" because the turbocharger housing was already included as a subcomponent of the component type "heat exchanger."

Also, the applicant explained that in LRA Table 3.3.2-11, the component type "heat exchanger (header)" was intended to represent the component type "turbocharger housing" in the corresponding LRA Table 2.3.3-11. To improve clarity, the applicant added a new row "turbocharger housing (heat exchanger)" with an environment of closed cooling water into LRA Table 3.3.2-11 to clearly identify that there is an associated aging management evaluation for the component type "turbocharger housings."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.16-1 acceptable because the applicant has identified that in LRA Table 2.3.3-16, the component type "turbocharger housing" was already included as a subcomponent of the component type "heat exchanger," which has a cooling water environment in LRA Table 3.3.2-16. Also, the applicant added the component type "turbocharger housing (heat exchanger)" to LRA Table 3.3.2-11 to assure that an aging management evaluation is performed for the turbocharger housings exposed to closed cycle cooling water. Therefore, the staff's concern described in RAI 2.3.3.16-1 is resolved.

2.3.3.16.3 Conclusion

The staff reviewed the LRA, RAI response, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the EDG water cooling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.17 Emergency Response Facility Substation System (Common)

2.3.3.17.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.17, the applicant described the ERF for the BVPS substation system (common), as common and used by both Units 1 and 2. The system receives standby power from a diesel generator, which supplies power to the ERF substation 4kV switchgear for selected equipment in the ERF substation, the ERF itself, and Units 1 and 2.

The ERF diesel generator has mechanical support equipment grouped into the following subsystems:

- Air Intake and Exhaust System
- Fuel Oil System
- Lube Oil System
- Water Cooling System

A turbocharger supplies combustion air and is mounted at the generator end of the engine. It consists of an exhaust-driven turbine unit and a centrifugal air compressor within a single housing and is mounted on a common shaft. An exhaust muffler/silencer is downstream of the turbocharger exhaust outlet.

The diesel generator fuel oil system consists of pumps, tanks, filters, strainers, fuel injectors, valves, piping, and instrumentation. This system does not incorporate any engine-mounted day tank.

The fuel oil transfer pumps, located in a below-grade enclosure, draw fuel oil from the underground fuel oil storage tank located northwest of the switchyard relay building and transfers it to the fuel oil day tank in the ERF diesel generator building. The storage tank capacity can supply diesel operation for seven days. An engine-mounted fuel pump and a fuel-priming pump powered by DC supplies fuel oil from the day tank to the diesel fuel injectors.

The diesel engine lube oil system is a combination of four separate systems; namely, main lubricating, piston-cooling, auxiliary oil, and scavenging oil systems, each with its own oil pump. Auxiliary motor-driven pumps continuously operate to circulate oil from the lube oil sump to the lube oil cooler. These pumps circulate warm oil through the oil system to keep the engine in a state of readiness for immediate start and loading.

The water cooling system for the diesel consists of an expansion tank, centrifugal circulating pumps, standby immersion heater, thermostatic control valve, and radiator. The outside radiator removes heat from the cooling water. The diesel radiator located to the east of the ERF diesel generator building has two fans and circulating pumps that provide radiator flow. An electric immersion heater provides for standby heating of diesel engine cooling water and lube oil.

The emergency response facility substation system (common) performs functions that support fire protection and ATWS.

LRA Table 2.3.3-17 identifies emergency response facility substation system (common) component types within the scope of license renewal and subject to an AMR:

- bolting
- expansion joint
- filter housing
- flexible hose
- heat exchanger
- heater housing
- orifice
- piping
- pump casing
- sight glass
- silencer
- strainer body
- strainer element
- tank
- tubing
- turbocharger housing
- valve body

The intended functions of the emergency response facility substation system (common) component types within the scope of license renewal include:

- filtration
- restriction for flow rate limit or pressure difference
- heat transfer
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product

barrier for containment pressure boundary, or containment isolation for fission product retention

2.3.3.17.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.17 and UFSAR Section 8.4.5 for Unit 1 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.17, the staff 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 LRA drawing 1-58E-1, the staff noted that the applicant highlighted a component labeled "injector," as being included within the scope of license renewal pursuant to 10 CFR 54.4(a). However, in LRA Tables 2.3.3-17 and 3.3.2-17, the applicant did not list the injector as a component type with an intended function of pressure boundary. In RAI 2.3.3.17-1, dated April 17, 2008, the staff requested that the applicant clarify whether the component type "injector" should be included within the scope of license renewal in LRA Tables 2.3.3-17 and 3.3.2-17.

In its response to RAI 2.3.3-17, dated May 19, 2008, the applicant stated that the fuel injectors are in-scope, but are active subcomponents of the diesel engine and are not subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-1 acceptable because the applicant has clarified that the injectors are within the scope of license renewal, but are not subject to an AMR because they are active components. Therefore, the staff's concern described in RAI 2.3.3.17-1 is resolved.

In UFSAR Section 9.5A.1.2.3.1.12 for Unit 2, the staff noted the applicant's statement that the black diesel, located in Unit 1, supplies electric power to the station air compressors subsequent to the LOOP. However, in LRA Section 2.3.3-17, the applicant does not describe this function as a part of the system in accordance with 10 CFR 54.4(a)(3). In RAI 2.3.3.17-2, dated April 17, 2008, the staff requested that the applicant justify why the function of the black diesel, which supplies the station air compressors, should not be included as an intended function pursuant to 10 CFR 54.4(a)(3).

In its response, dated May 19, 2008, the applicant stated:

> FENOC no longer credits the station air compressors in achieving safe shutdown, and no longer credits the ERFS diesel generator (i.e., black diesel) with powering the station air compressors at BVPS Unit 2 in achieving post-fire safe shutdown. A change notice, CN 06-575; was approved by FENOC to

modify the text in several subsections of the Unit 2 UFSAR, Sections 9.2 and 9.5A.1, to reflect this change to the CLB.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-2 acceptable because the applicant has identified a change notice that no longer credits the black diesel for post-fire safe-shutdown as an intended function pursuant to 10 CFR 54.4(a)(3). Therefore, the staff's concern described in RAI 2.3.3.17-2 is resolved.

The staff noted that in the Fire Protection Safe Shutdown Report, Section 3.50.3 for Unit 2, the applicant stated that the black diesel is assumed lost following a fire in Unit 1. However, in LRA Section 2.3.3-17, the applicant stated that the black diesel supplies the dedicated nonsafety-related auxiliary feedwater (AFW) pump for Unit 1 with a highly reliable source of electrical power. In RAI 2.3.3.17-3, dated April 17, 2008, the staff requested that the applicant explain whether the black diesel is assumed lost in a Unit 1 fire, how the diesel can supply power to the dedicated non safety-related AFW pump for Unit 1, which is credited in a Unit 1 fire that causes the loss of the three safety-related AFW pumps.

In its response to RAI 2.3.3.17-3, dated May 19, 2008, the applicant stated that "the postulated BVPS Unit 1 fire affecting the ERF diesel generator (black diesel) is evaluated in the Unit 2 fire protection safe-shutdown report and is in a different building, separate and remote from the postulated fire that could affect all three Unit 1 safety-related AFW pumps evaluated in the Unit 1 fire protection Appendix R report."

The applicant also explained that only Unit 1 fire areas of the ERF system building and ERF diesel generator building are evaluated for Unit 2 safe-shutdown because the normal source of Unit 2 compressed air is powered from the ERF system. The ERF system building and the ERF diesel generator building are not evaluated as fire areas in the Unit 1 fire protection Appendix R report since they do not support equipment used for safe-shutdown of Unit 1.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-3 acceptable because the applicant has confirmed that the black diesel is in the ERF diesel generator building, which is separate and remote from the Unit 1 fire area (i.e., the Unit 1 main steam cable vault area) that causes the simultaneous loss of all three Unit 1 safety-related AFW pumps, and that simultaneous fires in the two fire areas are outside the CLB.
Therefore, the staff's concern described in RAI 2.3.3.17-3 is resolved.

In UFSAR Section 8.4.5 for Unit 1, the staff noted the applicant's description of a buried 30,000 gallon fuel oil storage tank. However, in LRA Table 3.3.2-17, the applicant does not include an exterior environment of soil listed for component type "tank."

In RAI 2.3.3.17-AMR-1, dated April 17, 2008, the staff requested that the applicant clarify that the 30,000 gallon fuel storage tank is subject to an AMR or justify its exclusion.

In its response to RAI 2.3.3.17-AMR-1, dated May 19, 2008, the applicant stated that "the 30,000 gallon fuel storage tank discussed in the Unit 1 UFSAR Section 8.4.5 is identified as 1RGF-TK-1 and is within scope and subject to an AMR. The tank is a fiberglass tank that is located below grade in an enclosure backfilled with pea gravel." The applicant revised LRA Table 3.3.2-17, row 115 to reflect the external environment for this tank from "air-indoor uncontrolled" to "soil," to provide clarity.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-AMR-1 acceptable because the applicant has modified the external environment of the below grade fuel storage tank in order to more accurately portray its external environment and has clarified that the tank is subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.17-AMR-1 is resolved.

2.3.3.17.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the emergency response facility substation system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.18 Fire Protection Systems

2.3.3.18.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.18, the applicant described the fire protection system (FPS), which detects and suppresses fires in protected structures to ensure that no single fire causes an unacceptable risk to public health and safety, prevents any necessary safe-shutdown functions, or significantly increases the risk of radioactive release to the environment. The system consists of subsystems with detection, suppression, fire barrier, combustible oil collection, and shutdown functions.

Two fire pumps (one motor-driven and one diesel-driven) supply the water suppression subsystem. Both pumps, located in the intake structure, take suction from the Ohio River and discharge to the yard fire loop. The yard loop supplies fire hydrants, hose stations, and sprinkler systems throughout the plant. The water suppression system consists of pumps, piping, hydrants, hose stations, manual valves, deluge valves, and sprinkler heads. Hydrants protect the yard areas and hose stations located in buildings are for internal use.

The CO_2 suppression subsystem consists of refrigeration units for area and equipment enclosure protection and CO_2 discharge may be automatic or manual. Upon actuation of these systems, an alarm sounds to permit personnel to exit the affected area before the discharge.

Halon fire extinguishing subsystems provide suppression in areas with electronic computer parts or equipment. The systems may actuate either automatically or manually.

The fire detection subsystem consists of smoke-and heat-sensitive devices (and ultraviolet flame detectors at Unit 2) that monitor areas of the plant. When the devices sense smoke or heat, a fire alarm sounds and the area fire alarm displays in the control room.

The RCPs have a system for collecting lube oil leakage and draining it to containers that can hold the entire RCP lube oil inventory.

The fire barrier subsystems are construction elements rated in hours of fire resistance to prevent the spread of fires. LRA Section 2.4.36 addresses these fire barrier components as bulk structural commodities.

The FPS contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the FPS potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the FPS performs functions that support fire protection and EQ.

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

- bolting
- expansion joint
- flame arrestor
- flexible hose
- heat exchanger
- hose rack
- nozzle
- orifice
- piping
- pump casing
- sight glass
- silencer
- strainer body
- tank
- tubing
- valve body

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

- control of flow distribution or direction, spray shield, or curbs for flow direction
- restriction for flow rate limit or pressure difference
- prevention of fire spread by flame preclusion
- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related SSCs caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention

2.3.3.18.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.18, LRA drawings, UFSAR 9.10 for Unit 1, and UFSAR 9.5.1 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff also reviewed the following fire protection CLB documents for Units 1 and 2 listed in the Units 1 and 2 Operating License Conditions 2.C.5 and 2.F, respectively:

<u>Fire Protection SERs – Unit 1</u>

- Amendment No. 18, Beaver Valley Power Station Unit No. 1, Operating License DPR 66
- Updated Fire Protection Appendix R Review Report (Unit 1)

<u>Fire Protection SERs – Unit 2</u>

- NUREG-1057, October 1985 and Supplements 1 through 6 (Unit 2)

In addition, the staff reviewed the commitments to 10 CFR 50.48, “Fire protection” (*i.e.*, approved fire protection program) for Unit 1, using the applicant’s commitment documents to Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976.” and contained within the applicant’s fire protection CLB documents.

Further, the staff reviewed the commitments to 10 CFR 50.48 for Unit 2, using the applicant’s commitment to the BTP Chemical and Mechanical Engineering Branch (CMEB) 9.5-1, “Guidelines for Fire Protection for Nuclear Power Plants,” BTP APCSB 9.5-1, Appendix A, and 10 CFR Part 50, Appendix R. The applicant has committed the fire protection program for Unit 2 to these guidelines.

The staff reviewed LRA Section 2.3.3.18 and determined 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 2.3.3.18-1(a-e), dated April 17, 2008, the staff requested that the applicant verify whether each of the systems and components noted below are within 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), or justify their exclusion.

In LRA drawing 1-33-1, Revision 4, the staff noted that the applicant has shown the following FPS components as not within the scope of license renewal (*i.e.*, not colored in red), (RAI 2.3.3.18-1a):

- Fuel transfer pump and associated components
- 475 gallon hydro pneumatic tank FP-TK-1

In LRA drawing 1-33-3, Revision 4, the staff noted that the applicant has shown the following FPS components as not within the scope of license renewal (*i.e*., not colored in red), (RAI 2.3.3.18-1b):

- Carbon dioxide (CO_2) refrigeration system
- CO_2 purge system

In LRA drawing 1-33-4, Revision 4, the staff noted that the applicant has shown the following FPS components as not within the scope of license renewal (*i.e*., not colored in red), (RAI 2.3.3.18-1c):

- Electrical equipment room and diesel generator room CO_2 fire suppression system
- Halon 1301 fire suppression system

In LRA drawing 1-33-7, Revision 4, the staff noted that the applicant has shown the following FPS components as not within the scope of license renewal (*i.e*., not colored in red), (RAI 2.3.3.18-1d):

- Northeast and southwest turbine building fire suppression system
- Relay building fire suppression system

In LRA drawing 2-33-1F, Revision 5, the staff noted that the applicant has shown the following FPS components as not within the scope of license renewal (*i.e*., not colored in red), (RAI 2.3.3.18-1e):

- Deluge system for Transformers TR-2, TR-2A, TR-2B, TR-2C, and TR-2D
- Turbine building fire suppression systems
- Decontamination building fire suppression systems

In its response to RAI 2.3.3.18-1a, dated May 19, 2008, the applicant stated the following:

> The un-highlighted fire protection fuel transfer pump and associated components outside of the pump cubicle, which are associated with the diesel-driven fire pump, are not within the scope of license renewal. The fuel oil storage tank [FP-TK-2] shown on drawing LR 1-33-1, Revision 5, is sized to supply fuel oil for a period of 8 hours with pump operation at full capacity. The fuel transfer pump and associated piping are not classified as safety-related. No additional source of fuel is credited for operation of the pump for any 10 CFR 54.4(a) function. The fuel makeup pump and piping (outside the pump cubicle) are physically separated from all safety-related equipment, and their integrity is not required to avoid spatial interactions with safety-related components. The hydro pneumatic tank, FP-TK-1, is in scope for license renewal, but highlighting was inadvertently omitted on LRA drawing LR 1-33-1, Revision 4; drawing LR-1-33-1 was corrected (Revision 5) and submitted as errata on 12/21/2007.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-1a acceptable because the applicant has confirmed that the fuel transfer pump and associated components are properly shown in LRA drawing 1-33-1, Revision 4 as out of scope for license renewal. The pump and associated components in question are not credited to meet the requirements of Appendix R for achieving safe-shutdown in the event of a fire.

The applicant inadvertently left as un-highlighted, the hydro pneumatic tank, FP-TK-1 on the LRA drawing, although it was identified as within the scope of license renewal and subject to an AMR. The applicant corrected the LRA drawing in its December 21, 2007 submission. Therefore, the staff's concern described in RAI 2.3.3.18-1a is resolved.

In its response to RAI 2.3.3.18-1b, dated May 19, 2008, the applicant stated the following:

> The carbon dioxide (CO_2) refrigeration components are not within the scope of license renewal. The refrigeration subsystem is not needed to maintain CO_2 tank operability. Operability requirements for the tank are based on CO_2 level and pressure. The CO_2 is stored in liquid form at saturation conditions. Excess heat that is not removed by the refrigeration components results in the temperature of the CO_2 rising. Since the CO_2 is at saturation conditions, the tank pressure rises slightly with temperature until the pressure equals that of the bleeder relief valves' set point. Both CO_2 storage tanks have bleeder relief valves and a large capacity safety valve that maintain system pressure. Under loss of refrigeration, the bleeder valve can maintain self refrigeration of the CO_2 unit and the CO_2 tank pressure will remain in the operable range. Tank levels are monitored by low level alarms and operator periodic checks. Additional CO_2 would be added as necessary to maintain levels within the operable range. The CO_2 purge system depicted on drawing LR 1-33-3, Grids F-6 through G-7, is not within the scope of license renewal. This subsystem provides for the purging of air or hydrogen from the main generator for maintenance. It is unrelated to 10 CFR 54.4(a)(3) fire protection functions or other 10 CFR 54.4(a) criteria, and is, therefore, not within the scope of license renewal. Unit I UFSAR, Table 9.10-2, "Areas in which Fire Detection/ Suppression is Outside the Scope of 50.48 Fire Protection," identifies the Main Generator CO_2 Purge System (used for purging H2 during shutdown and CO_2 during startup) as outside the scope of 10 CFR 50.48 Fire Protection."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-1b acceptable because the applicant has satisfactorily clarified the exclusion of the CO_2 refrigeration and purge system from the scope of license renewal and not subject to an AMR. The applicant stated that the CO_2 refrigeration and purge systems are not relied upon for compliance with 10 CFR 50.48 and do not have a license renewal intended function. The staff confirmed that, although the CO_2 system is addressed in the SER for Unit 2 (NUREG-1057) and in the UFSAR for Unit 1, it is not relied on for compliance with 10 CFR 50.48. Further, the CO_2 purge system for Unit 2, used for purging H_2 during shutdown and CO_2 during startup, is not credited for Appendix R for achieving safe-shutdown in the event of a fire. Therefore, the staff's concern described in RAI 2.3.3.18-1b is resolved.

In its response to RAI 2.3.3.18-1c, dated May 19, 2008, the applicant stated the following:

> The CO_2 and Halon subsystems depicted on drawing LR 1-33-4, Grids B-6 through G-10, are not within the scope of license renewal. These CO_2 and Halon subsystems provide fire suppression for equipment located in the Guard House

> (also known as the Security Building). Fire protection in this area is provided for commercial purposes only. A fire in this area would not affect the ability to achieve safe-shutdown. Unit 1 UFSAR, Table 9.10-2, identifies the Security Building as outside the scope of 10 CFR 50.48 Fire Protection.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-1c acceptable because the applicant has confirmed that the Guard House (also known as the Security Building) is not safety-related, cannot affect safety-related equipment by spatial interaction, nor required for safe-shutdown. The staff finds that the security building has no intended function pursuant to 10 CFR 54.4(a)(2) and as a result, the applicant has correctly excluded the CO_2 and Halon subsystems in the Guard House from the scope of license renewal and; thus, is not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.18-1c is resolved.

In its response to RAI 2.3.3.18-1d, dated May 19, 2008, the applicant stated the following:

> The fire protection equipment shown on LRA drawing 1-33-7 that is not highlighted is not within the scope of license renewal. This equipment supplies fire suppression water to outside transformers (Main transformer, and Station Service Transformers 1A, 1C and 1D) and to outside transformers in the switchyard. Fire protection for these areas is provided for commercial purposes only. A fire in these areas would not affect the ability to achieve safe-shutdown. Unit 1 UFSAR, Table 9.10-2, identifies the Relay Building (Switchyard) as outside the scope of 10 CFR 50.48 Fire Protection.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-1d acceptable because the applicant has confirmed that the main transformer and station service transformers 1A, 1C and 1D fire suppression water systems do not mitigate fires in areas containing equipment important to safe operation of the plant, nor are they credited with achieving safe-shutdown in the event of a fire. Since they are outdoors, away from safety-related equipment, the main transformer and station service transformers 1A, 1C and 1D cannot affect safety-related equipment by spatial interaction. Therefore, the staff finds that the main transformer and station service transformers 2A, 2B, 2C, and 2D fire suppression water systems were correctly excluded from the scope of license renewal and not subject to an AMR. Further, the applicant stated that the FPSs for these transformers are only provided due to insurance requirements. Therefore, the staff's concern described in RAI 2.3.3.18-1d is resolved.

In its response to RAI 2.3.3.18-1e, dated May 19, 2008, the applicant stated the following:

> The fire protection equipment shown on LRA drawing 2-33-1 F that is not highlighted is not within the scope of license renewal. This equipment supplies fire suppression water to outside transformers (Main transformer, and Station Service Transformers 2A, 2B, 2C, and 2D). Fire protection for these areas is provided for commercial purposes only. Unit 2 UFSAR, Section 9.5A.1.3.53.1, specifies that, "The isolation of the transformers from any safety-related equipment or areas precludes any possible effect on the ability to attain safe shutdown due to a transformer fire." A fire in these areas would not affect the ability to achieve or maintain safe shutdown and would not affect the ability to minimize and control a release of radioactivity. Unit 2 UFSAR, Table 9.5-12, "Areas in which Fire Detection / Suppression is Outside the Scope of 50.48 Fire Protection," includes the outside transformers, in the list of areas containing fire

> protection equipment that is outside the scope of 10 CFR 50.48 Fire Protection. The Turbine Building and Decontamination Building fire suppression systems are not supplied by this piping. The references to Turbine and Decontamination Building at the left side of LR Drawing 2-33-1 F identify the locations of the fire water supplies for the transformer suppression, not the area being protected.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-1e acceptable because the applicant has confirmed that the main transformer and station service transformers 2A, 2B, 2C, and 2D fire suppression water systems do not mitigate fires in areas containing equipment important to safe operation of the plant, nor are they credited with achieving safe-shutdown in the event of a fire. Since they are outdoors and away from safety-related equipment, the main transformer and station service transformers 2A, 2B, 2C, and 2D cannot affect safety-related equipment by spatial interaction. Therefore, the staff finds that the main transformer and station service transformers 2A, 2B, 2C, and 2D fire suppression water systems were correctly excluded from the scope of license renewal and not subject to an AMR. Further, the applicant stated that the FPSs for these transformers are only provided due to insurance requirements. Therefore, the staff's concern described in RAI 2.3.3.18-1e is resolved.
Since the applicant has satisfactorily addressed all five parts of RAI 2.33.18-1, all staff concerns described in RAI 2.3.3.18-1(a-e) are resolved.

In UFSAR Section 9.10.2, Revision 22, Interim Issue 3, for Unit 1, the staff noted the applicant's discussions regarding various types of fire water suppression systems provided in the plant areas for fire suppression activities. These fire suppression systems are located in the following areas:

- Turbine room under floors
- Turbine building auxiliary bay
- Turbine oil room
- Chemistry laboratory
- Auxiliary feedwater pump area
- Residual heat removal pump area
- Redundant cable penetrations area
- Reactor plant component cooling water pump area

In RAI 2.3.3.18-2, dated April 17, 2008, the staff requested that the applicant verify whether the fire water suppression systems installed in the various areas of the plant noted above are within the scope of license renewal pursuant to 10 CFR 54.4(a) and subject to an AMR in accordance with 10 CFR 54.21(a)(1) and if excluded, provide justification for the exclusion.

In its response to RAI 2.3.3.18-2, dated May 19, 2008, the applicant stated the following for the areas in question (note that, by identifying the appropriate LRA drawings for the various items, the applicant has provided the proper indication that the item is included within the scope of license renewal):

> Turbine room under floors - the flowpaths to the sprinkler systems for the turbine room under floors in the Turbine room basement and mezzanine are shown on LRA drawing LR 1-33-1, within the Turbine Building area defined by Grids D-4 to G-9, at Grids D-5 and E-5, and on drawing 1-33-7, the flow path continues to the Turbine room basement and mezzanine through alarm check (AC) valves AC-1 FP-1 and AC-1 FP-2, respectively, in Grids A-9 through C-10.

Based on its review, the staff finds the applicant's response acceptable because the applicant has identified and adequately discussed the fire water sprinkler system under floors of the turbine room as within the scope of license renewal and subject to an AMR. The staff confirms that the fire water sprinkler system under the floors of the turbine room is correctly included within the scope of license renewal and subject to an AMR. Therefore, the staff's concern with the turbine room under floors is resolved.

> Turbine Building auxiliary bay - there are two (2) sources of fire suppression for the auxiliary bay; hoses and sprinklers, shown on LRA drawing LR 1-33-1 at Grids F-3 for the hoses, and G-4 for the sprinkler supply to valve AC-FP-4, shown on drawing 1-33-7 at Grid E-5. Valve AC-FP-4 supplies the sprinklers to the auxiliary bay and cold chemistry laboratory, which are adjacent to one another and share the sprinkler source.

Based on its review, the staff finds the applicant's response acceptable because the applicant has clarified that the TB auxiliary bay has two sources of fire suppression; namely, hoses and sprinklers, and that the TB auxiliary bay system suppression system lies within the scope of license renewal and subject to an AMR. The staff confirms that the TB auxiliary bay system suppression system is correctly included within the scope of license renewal and is subject to an AMR. Therefore, the staff's concern with the turbine building auxiliary tray is resolved.

> Turbine oil room - sprinkler supply to the turbine oil room is shown on LRA drawing 1-33-1 at grid D-8, and drawing 1-33-7 at Grid D-5, through valve AC-FP-3 to the sprinklers.

Based on its review, the staff finds the applicant's response acceptable because the applicant appropriately has identified the turbine oil room sprinkler system and its components (piping and valves) as within the scope of license renewal and subject to an AMR.

The staff confirms that the turbine oil room sprinkler system and its components (piping and valves) are correctly within the scope of license renewal and subject to an AMR. Therefore, the staff concern with the turbine oil room is resolved.

> Chemistry laboratory - the sprinkler supply to the chemistry laboratory is shown on LRA drawing 1-33-2 at Grid B-3, to drawing 1-33-8, through valve AC-FP-7 to the sprinklers shown at Grid B-1.

Based on its review, the staff finds the applicant's response acceptable because the applicant appropriately has identified the chemistry laboratory sprinkler system as within the scope of license renewal and subject to an AMR. The staff confirms that the chemistry laboratory sprinkler system and its associated components are correctly included within the scope of license renewal and subject to an AMR. Therefore, the staff's concern with the chemistry laboratory is resolved.

> Auxiliary feedwater pump area - the flowpath for fire protection water supply to the auxiliary feedwater pump area is shown on LRA drawing 1-33-2 at Grid C-3, then to drawing 1-33-7 through deluge valve (DV) DV-FP-12 at Grid A-3.

Based on its review, the staff finds the applicant's response acceptable because the applicant has adequately clarified the flowpath for the auxiliary feedwater pumps area sprinkler system. The staff confirms that the auxiliary feedwater pumps area sprinkler system and its associated components are correctly included within the scope of license renewal and subject to an AMR. Therefore, the staff's concern with the auxiliary feedwater pumps area is resolved.

> Residual heat removal pump area - the flowpath for the RHR area fire protection water is shown on LRA drawing 1-33-2 at Grid C-3 as the supply to valve DV-FP-13, then to drawing 1-33-7 to valve DV-FP-13 at Grid C-3.

Based on its review, the staff finds the applicant's response acceptable because the applicant has identified and adequately discussed the flowpath for the RHR pump area sprinkler system. The staff confirms that the applicant correctly identified the RHR pump area sprinkler system and its components as within the scope of license renewal and subject to an AMR. Therefore, the staff's concern with the RHR pump area is resolved.

> Redundant cable penetrations area - there are three (3) deluge valves that supply fire protection water to the redundant cable penetration area. LRA drawing 1-33-2 at Grid C-2 shows the supply to valve DV-FP-14 (main supply valve in series with the other two deluge valves) with the flowpath continuing to grid D-5 for the supply to valves DV-FP-20 and DV-FP-19. Deluge valve DV-FP-14 is shown on drawing 1-33-7 at grid D-3, and drawing 1-33-8 shows the other two deluge valves at Grids E-9 through G-10, with valve DV-FP-19 supplying the east cable penetration sprinkler risers and valve DV-FP-20 supplying the west cable penetration sprinkler risers.

Based on its review, the staff finds the applicant's response acceptable because the applicant has adequately explained that the cable penetrations area fire suppression system is within the scope of license renewal and subject to an AMR. The applicant also adequately discussed details of redundant cable penetrations area fire suppression system.
The staff confirms that the applicant properly identified the flowpath of the redundant cable penetrations area fire suppression system and its components as within the scope of license renewal and subject to an AMR. Therefore, the staff's concern with the redundant cable penetrations area is resolved.

> Reactor plant component cooling water pump area - the flowpath for the fire protection water deluge supply to the component cooling water pump area is shown on LRA drawing 1-33-2 at Grid D-9 and then on drawing 1-33-8 at Grid C-9 for valve DV-FP-17.

Based on its review, the staff finds the applicant's response acceptable because the applicant has adequately explained that the reactor plant component cooling water pump area fire water sprinkler system is within 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). The staff confirms that the applicant properly identified the reactor plant component cooling water pump area fire water sprinkler system as within the scope of license renewal and subject to an AMR. Therefore, the staff's concern with the reactor plant component cooling water pump area is resolved.

Since all items in RAI 2.3.3.18-2 have been satisfactorily addressed by the applicant, the staff's concerns described in RAI 2.3.3.18-2 are resolved.

In UFSAR Section 9.10.2, Revision 22, Interim Issue 3 for Unit 1, the staff noted the applicant's discussion regarding CO_2 systems provided in the plant areas for fire suppression activities. The CO_2 systems are located in the following areas:

- Cable vault areas
- Cable tray mezzanine area
- Diesel generator rooms

In RAI 2.3.3.18-3, dated April 17, 2008, the staff requested that the applicant verify whether the above CO_2 systems installed in various areas of the plant are within the scope of license renewal pursuant to 10 CFR 54.4(a) and subject to an AMR in accordance with 10 CFR 54.21(a)(1) and if excluded, provide justification for the exclusion.

In its response to RAI 2.3.3.18-3, dated May 19, 2008, the applicant stated that the Unit 1 CO_2 suppression systems for each of the bulleted areas are within the scope of license renewal and are subject to AMR. The following list identifies the LRA drawings that depict those subsystems in scope (highlighted in red):

- Cable vault areas - LRA drawing 1-33-3, Grid G-3, depicts storage unit FP-C-2, supplying the east and west cable vault areas in Grids C-1 through D-5.
- Cable tray mezzanine area - LRA drawing 1-33-3, Grid G-3, depicts storage unit FP-C-2, supplying the cable tray mezzanine in grids A-1 through B-5.
- Diesel generator rooms - LRA drawing 1-33-3, Grid G-3, depicts storage unit FP-C-2, supplying the diesel generator rooms in, Grids E-5 through G-5.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-3 acceptable because the applicant has adequately explained that the Unit 1 CO_2 suppression systems and components in question are within the scope of license and subject to an AMR, by referencing the appropriate LRA drawing 1-33-3.

The staff is assured that the Unit 1 cable vault areas, cable tray mezzanine area, and diesel generator rooms CO_2 fire suppression systems will be considered appropriately during the aging management activities. The staff concludes that the Unit 1 CO_2 suppression systems and components were correctly included within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.18-3 is resolved.

In UFSAR Section 9.10.2, Revision 22, Interim Issue 3 for Unit 1, the staff noted the applicant's discussion of Halon fire suppression systems for the primary process rack area and cable tunnel. The staff noted that the Halon 1301 systems do not appear in LRA Section 2.3.3.18 as being within the scope of the license renewal and subject to an AMR.

In RAI 2.3.3.18-4, dated April 17, 2008, the staff requested that the applicant verify whether the above Halon 1301 systems are within 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) and if not, provide justification for the exclusion.

In its response dated May 19, 2008, the applicant stated the following:

> The Halon fire suppression systems for the Unit 1 primary process rack area and cable tunnel are within the scope of license renewal and are subject to AMR. The process rack area Halon systems are shown in scope (highlighted in red) on LRA drawing 1-33-4, Grids E-1 through G-4, and the cable tunnel Halon system is shown on the same drawing, Grids A-1 through B-4. These subsystems are described in LRA Section 2.3.3.18 (LRA Page 2.3-87) -- "Halon fire extinguishing subsystems are utilized for suppression in areas where electronic computer parts or equipment is used. The systems may be actuated either automatically or manually." The Halon subsystems are responsible for the LRA Section 2.3.3.18 System Intended Function under 10 CFR 54.4(a)(3) (LRA page 2.3-88) -- "Provides automatic or manual Halon fire suppression system capability."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-4 acceptable because the applicant correctly identified the Halon fire suppression systems for the Unit 1 primary process rack area and cable tunnel and its associated components as within the scope of license renewal and subject to an AMR. The staff concludes that the Unit 1 primary process rack area and cable tunnel Halon system and associated components are correctly included within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.18-4 is resolved.

The staff reviewed NUREG-1057, "Safety Evaluation Report Related to the Operation of Beaver Valley Power Station Unit 2," Section 9.5.1.5, dated October 1985, and noted that the jockey pump maintains the fire water system pressure, indicating that this pump has a fire protection function and implying that it should be included within the scope of license renewal. The staff also noted that the jockey pump and associated components do not appear in LRA Section 2.3.3.18 as being within the scope of the license renewal and subject to an AMR.

In RAI 2.3.3.18-5, dated April 17, 2008, the staff requested that the applicant verify whether the jockey pump and components are within the scope of license renewal pursuant to 10 CFR 54.4(a) and subject to an AMR in accordance with 10 CFR 54.21(a)(1) and if not, provide justification for the exclusion.

In its response to RAI 2.3.3.18-5, dated May 19, 2008, the applicant stated:

> The fire protection jockey pump FP-P-3 and associated piping and hydro pneumatic tank are in scope for license renewal and subject to AMR. The jockey pump, hydro pneumatic tank, and associated components are presented in LRA Table 2.3.3-18 as "Pump casing," "Piping," "Valve body" and "Tank" components types, and are shown in scope (highlighted in red) on LRA drawing 1-33-1, Grids A-1 through B-2.
>
> FENOC currently uses the filtered water system instead of the jockey pump and hydro pneumatic tank as the normal pressure maintenance source for the fire protection system, but the filtered water system is not credited with any intended function for license renewal, and the portion of the system that supplies makeup to the fire protection system is not within the scope of license renewal. Failure of the filtered water system to maintain pressure in the fire protection system would

> not affect the ability of the fire protection water suppression system to perform any intended function. A rupture or leak in the filtered water system can be isolated from the fire protection system at the in-scope system interface valve FP-1 052, shown on LR Drawing 1-33-1, Grid E-9. The fire pumps are capable of running on recirculation to maintain system pressure, and are continuously available to provide suppression flow. Restoration of filtered water supply to the fire protection system for normal pressure maintenance would be an item of maintenance convenience, not one of fire protection operability.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-5 acceptable because the applicant has identified the jockey pump and hydro-pneumatic tank and their associated components as within the scope of license renewal and subject to an AMR. The applicant stated that the jockey pump and hydropneumatic tank are included in the component type "Pump Casing," "Piping," "Valve body" and "Tank" listed in LRA Table 2.3.3-18. The staff has confirmed that the applicant has correctly identified the jockey pump and hydro pneumatic tank and associated components within the scope of license renewal and subject to an AMR. Therefore, the staff concern described in RAI 2.3.3.18-5 is resolved.

The staff reviewed SER (NUREG-1057) Section 9.5.1.5 and UFSAR Section 9.5.1.7.3, Revision 2, Interim Issue 2 for Unit 2, where the applicant discussed various types of fire water suppression systems that are provided in the plant areas for fire suppression activities. The fire suppression systems are as follows:

- water spray system for condensate polishing building charcoal filter
- water spray system for fuel and decontamination building charcoal filter
- water spray system for auxiliary building general area
- deluge water spray systems for reactor containment areas (charcoal filter banks, RHR pumps, and orange purple cable penetrations area)
- automatic water deluge spray system for south safeguards area AFW pump room
- wet pipe sprinkler system for turbine building (under operating and mezzanine floors)
- automatic water spray deluge water curtain at the entrance to the condensate polishing pipe tunnel
- deluge system for turbine oil reservoir and coolers
- automatic water spray deluge system for hydrogen seal oil unit
- sprinkler system for auxiliary boiler area
- dry pipe sprinkler system for South Office Shops Building (SOSB) railway bay

In RAI 2.3.3.18-6, dated April 17, 2008, the staff requested that the applicant verify whether the above fire water suppression systems installed in various areas of the plant are within the scope of license renewal pursuant to 10 CFR 54.4(a) and subject to an AMR in accordance with 10 CFR 54.21(a)(1) and if not, provide justification for the exclusion.

In its response to RAI 2.3.3.18-8, dated May 19, 2008, the applicant stated:

> Each of the bulleted fire water suppression systems, with the exception of those for the auxiliary boiler area and SOSB railway bay, are within the scope of license renewal and are subject to AMR.
>
> Fire protection systems for the auxiliary boiler area and SOSB railway bay are not within the scope of license renewal because a fire in these areas would not affect the ability of the BVPS Unit 2 to achieve safe-shutdown. Unit 2 UFSAR, Table 9.5-12, includes the Auxiliary Boiler Room and SOSB in the list of areas containing fire protection equipment that is outside the scope of 10 CFR 50.48 Fire Protection.
>
> The following list identifies the LRA drawings that depict the subsystems in scope (highlighted in red):
>
> - water spray system for condensate polishing building charcoal filter LRA drawing 2-33-1 F, Grid E-8
> - water spray system for fuel and decontamination building charcoal filter LRA drawing 2-33-1 B, Grid E-9 (the “fuel and decontamination building charcoal filter” refers to a single filter, associated with the fuel and decontamination building)
> - water spray system for auxiliary building general area - LRA drawing 2- 33-1A, left side, and drawing 2-33-1 C, Grids D-6 through F-7
> - deluge water spray systems for reactor containment areas (charcoal filter banks, RHR pumps, and orange purple cable penetrations area) - LRA drawing 2-33-1D (all)
> - automatic water deluge spray system for south safeguards area auxiliary feedwater pump room - LRA drawing 2-33-1 B, Grids C-1 through G-3
> - wet pipe sprinkler system for turbine building (under operating and mezzanine floors) - LRA drawing 2-33-1 E, Grids D-1 through G-4
> - automatic water spray deluge water curtain at the entrance to the condensate polishing pipe tunnel - LRA drawing 2-33-1 F, Grids F-8 through E-1 0
> - deluge system for turbine oil reservoir and coolers - LRA drawing 2-33-1 E, Grids E-8 through E-10
> - automatic water spray deluge systems for hydrogen seal oil unit – LRA drawing 2-33-1 E, Grids D-5 through D-7
> - sprinkler system for auxiliary boiler area - none; auxiliary boiler area fire protection is not in scope for license renewal
> - dry pipe sprinkler system for SOSB railway bay - none; SOSB railway bay fire protection is not in scope for license renewal

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-6 acceptable because the applicant has confirmed that the various types of Unit 2 fire water suppression systems are identified as within the scope of license renewal and subject to an AMR. The applicant stated that the sprinkler system for the auxiliary boiler room and dry pipe sprinkler system for the SOSB railway are not credited for 10 CFR 50.48, and therefore, not within the scope of the license renewal. Further, these two FPSs do not support Unit 2 post-fire safe-shutdown requirements. The staff concludes that the applicant has correctly identified the fire suppression systems installed in various areas of the plant that are within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.18-6 is resolved.

The staff reviewed SER (NUREG-1057) Section 9.5.1.5 and UFSAR Revision 2, Interim Issue 2, for Unit 2, where the applicant discussed the total flooding Halon 1301 suppression systems for the computer and west communications room. The staff noted that the total flooding Halon 1301 suppression systems do not appear in LRA Section 2.3.3.18 as being within the scope of the license renewal and subject to an AMR.

In RAI 2.3.3.18-7, dated April 17, 2008, the staff requested that the applicant verify whether the total flooding Halon 1301 suppression systems and its components are within the scope of license renewal pursuant to 10 CFR 54.4(a) and subject to an AMR in accordance with 10 CFR 54.21(a)(1) and if not, provide justification for the exclusion.

In its response to RAI 2.3.3.18-7, dated May 19, 2008, the applicant stated:

> The Halon suppression systems for the Unit 2 computer and west communications room are within the scope of license renewal and are subject to AMR. LRA drawing-2-33-3 (entire drawing) shows these systems in scope (highlighted in red). LRA drawing 2-33-3, however, does not include the term “west” in the title of the “communications room.” These subsystems are described in LRA Section 2.3.3.18 (LRA page 2.3-87) -- “Halon fire extinguishing subsystems are utilized for suppression in areas where electronic computer parts or equipment is used. The systems may be actuated either automatically or manually.” The Halon subsystems are responsible for the LRA Section 2.3.3.18 System Intended Function under 10 CFR 54.4(a)(3) (LRA page 2.3-88) -- “Provides automatic or manual Halon fire suppression system capability.”

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-7 acceptable because the applicant has confirmed that the Unit 2 total flooding Halon 1301 suppression systems for the computer and west communications room are within the scope of license renewal and subject to an AMR. Further, the applicant clarified that the LRA drawing 2-33-3 does not include the term “west” in the title of the “communications room.” These subsystems are described in LRA Section 2.3.3.18 (LRA page 2.3-87), “Halon fire extinguishing subsystems are utilized for suppression in areas where electronic computer parts or equipment is used.” The staff concludes that the total flooding Halon fire suppression systems and the associated components are correctly included within the scope of license renewal and subject to an AMR. Therefore, the staff’s concern described in RAI 2.3.3.18-7 is resolved.

The staff reviewed SER (NUREG-1057) Section 9.5.1.5 and UFSAR, Revision 2, Interim Issue 2, for Unit 2 where the applicant discussed the total flooding CO_2 systems provided in the plant areas for fire suppression activities. The CO_2 systems are located in the following areas:

- control building instrument and relay room
- cable spreading room
- cable tunnel

- cable vault/rod control building (El 735’-6” and El 755’-6”)
- orange diesel generator room, purple diesel generator room
- cable vault relay room
- service building cable tray area
- turbine generator

In RAI 2.3.3.18-8, dated April 17, 2008, the staff requested that the applicant verify whether the CO_2 systems installed in the above areas of the plant are within the scope of license renewal pursuant to 10 CFR 54.4(a) and subject to an AMR in accordance with 10 CFR 54.21(a)(1) and if not, provide justification for the exclusion.

In its response to RAI 2.3.3.18-8, dated May 19, 2008, the applicant stated:

> The Unit 2 CO_2 suppression systems for each of the bulleted areas are within the scope of license renewal and are subject to AMR. The following list identifies the LRA drawings that depict those subsystems in scope (highlighted in red):
>
> - Control building instrument and relay room - LRA drawing 2-33-2A, Grids C-10 and D-10.
> - Cable spreading room - LRA drawing 2-33-2A, Grid B-10.
> - Cable tunnel - LRA drawing 2-33-2A, Grid B-8.
> - Cable vault/rod control building (El. 735'-6" and El. 755'-6") - LRA drawing 2-33-2A, Grids C-5 to E-9.
> - Orange diesel generator room, purple diesel generator room - LRA drawing 2-33-2A, Grids G-4 and G-5.
> - Cable vault relay room - LRA drawing 2-33-2A, Grids F-9 to G-10.
> - Service building cable tray area - LRA drawing 2-33-2A, Grid F-8 and G-8.
> - Turbine generator- LRA drawing 2-33-2B (all).

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-8 acceptable because the applicant has correctly identified the total flooding CO_2 fire suppression systems for various areas for Unit 2 as within the scope of license renewal and subject to an AMR. The staff concludes that the total flooding CO_2 fire suppression systems for Unit 2 provided in the following locations: (a) control building instrument and relay room, (b) cable spreading room, (c) cable tunnel, (d) cable vault/rod control building (El 735’-6” and El 755’-6”), (e) orange diesel generator room, (f) purple diesel generator room, (g) cable vault relay room, (h) service building cable tray area, and (i) turbine generator and associated components, were correctly included within the scope of license renewal and subject to an AMR. Therefore, the staff’s concern described in RAI 2.3.3.18-8 is resolved.

The staff reviewed SER (NUREG-1057) Section 9.5.1.5 and UFSAR Section 9.5.1.8.5, Revision 2, Interim Issue 2 for Unit 2 where the applicant discussed standpipe hose stations for emergency switchgear rooms. The staff noted that the standpipe hose stations for switchgear rooms do not appear in LRA Section 2.3.3.18 as being within the scope of the license renewal and subject to an AMR.

In RAI 2.3.3.18-9, dated April 17, 2008, the staff requested that the applicant verify whether the standpipe hose stations for switchgear rooms are within the scope of license renewal pursuant to 10 CFR 54.4(a) and subject to an AMR in accordance with 10 CFR 54.21(a)(1) and if not, provide justification for the exclusion.

In its response to RAI 2.3.3.18-9, dated May 19, 2008, the applicant stated:

> The water suppression for the emergency switchgear rooms is provided by manual fire standpipe hose stations (hose racks) located in the stairwells adjacent to the switchgear rooms. These hose racks are within the scope of license renewal and are subject to AMR, and are listed as component type "hose rack" in LRA Table 2.3.3-18. They are shown in-scope (highlighted in red) on LRA drawing 2-33-1 B, Grids C-4 and C-5 (Service Building hose racks). Specifically, hose stations 219 and 220 are located outside of the emergency switchgear rooms.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-9 acceptable because the applicant has correctly identified the standpipe hose stations for the emergency switchgear rooms for Unit 2 as within the scope of license renewal and subject to an AMR. The applicant has evaluated standpipe hose stations as component type “hose racks” in LRA Table 2.3.3-18, which is within the scope for license renewal and subject to an AMR. The staff is assured that the standpipe hose stations used for fire suppression will be appropriately considered during plant aging management activities. Therefore, the staff’s concern described in RAI 2.3.3.18-19 is resolved.

The staff reviewed LRA Tables 2.3.3-18 and 3.3.2-18 and noted that the applicant has excluded several types of fire protection components that appear on the LRA drawings as within the scope of license renewal (i.e., highlighted in red). These components are listed below:

- hose connections
- interior fire hose stations
- pipe supports
- couplings
- threaded connections
- restricting orifices
- interface flanges
- chamber housings
- heat-actuated devices
- thermowells
- water motor alarms
- filter housing
- gear box housing
- turbocharger housing
- latch door pull box
- pneumatic actuators
- actuator housing
- dikes for oil spill confinement
- buried underground fuel oil tanks for emergency diesel generators
- fire water main loop valves
- post-indicator valves

- jacket cooling water keepwarm pump and heater
- lubricating oil cooler
- rocker lubricating oil pump
- floor drains and curbs for fire-fighting water
- backflow prevention devices
- flame retardant coating for cables
- fire retardant coating for structural steel supporting walls and ceilings

In RAI 2.3.3.18-10, dated April 17, 2008, the staff requested that the applicant verify whether the components listed above should be included in LRA Tables 2.3.3-18 and 3.3.2-18 and if not, provide justification for the exclusion.

In its response to RAI 2.3.3.18-10, dated May 19, 2008, the applicant stated:

> The components within the scope of License Renewal and within the fire protection system are grouped within the component type names listed in LRA Table 2.3.3-18. LRA Section 3.0.1.2 provides brief descriptions of the component type names used. Some components in the bulleted list for this question, perform functions associated with fire protection or safe-shutdown, but are contained within a system other than the fire protection system. For example, some of the bulleted component types questioned are associated with emergency diesel generators. While emergency diesel generators perform functions credited for fire protection, they are not evaluated within the fire protection system, but within the diesel generator systems (LRA Sections 2.3.3.11 through 2.3.3.17, and 2.3.3.29). Some components such as dikes, curbs and fire retardant coatings for structural steel are evaluated within the LRA as bulk structural commodities in LRA Section 2.4.36.
>
> Specifics for each bulleted component type are provided, including identification of those component types that are not in-scope or not subject to AMR:
>
> - Hose connections - outdoor fire protection hose connections exist on fire hydrants. Hydrants were evaluated as valves; they appear in Table 2.3.3-18 as “Valve body,” and are listed in Table 3.3.2-18 as “Valve body (hydrant).” Interior hose connections are located at hose racks, and are labeled “Hose rack” in Table 2.3.3-18, and “Hose rack (CO_2),” or "Hose rack (water)” in LRA Table 3.3.2-18.
> - Interior fire hose stations - labeled “Hose racks” in Table 2.3.3-18, and “Hose rack (CO_2),” or “Hose rack (water)” in LRA Table 3.3.2-18
> - Pipe supports - “Pipe supports” were evaluated as structural commodities in LRA Tables 2.4-36 and 3.5.2-36
> - Couplings - fire protection couplings were evaluated as piping components, and appear in LRA Table 2.3.3-18 as "Piping," and in LRA Table 3.3.2-18 as “Piping,” “Piping (buried),” “Piping (CO_2 fittings),” “Piping (CO_2),” “Piping (drained/vented),” “Piping (halon fittings),” “Piping (halon),” and “Piping (RCP oil collection)”
> - Threaded connections - fire protection threaded connections were evaluated as piping components, and appear in LRA Table 2.3.3-18 as "Piping," and in LRA Table 3.3.2-18 as “Piping,” “Piping (buried),” “Piping (CO_2 fittings),” “Piping

(CO_2)" "Piping (drained/vented)," "Piping (halon fittings)," "Piping (halon)," and "Piping (RCP oil Collection)"

- Restricting orifices - orifices are listed in LRA Tables 2.3.3-18 and 3.3.2-18 as "Orifice"
- Interface flanges - fire protection flanges were evaluated as piping components, and appear in Table 2.3.3-18 as "Piping," and in LRA Table 3.3.2-18 as "Piping," "Piping (buried)," "Piping (CO_2 fittings)," "Piping (CO_2)," "Piping (drained/vented)," "Piping (halon fittings)," "Piping (halon)," and "Piping (RCP oil collection)"
- Chamber housings - retarding chambers used in water suppression alarm circuits appear in LRA Table 2.3.3-18 as "Tank," and are listed in LRA Table 3.3.2-18 as "Tank (retarding chamber)"
- Heat-actuated devices - heat actuated devices are electrical fire detection devices that correspond to Nuclear Energy Institute NEI 95-10, "Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," Appendix B, "Typical Structure, Component and Commodity Groupings and Active/Passive Determinations for the Integrated Plant Assessment," Item 73, "Alarm Unit." These devices are active electrical components and are not subject to AMR per 10 CFR 54.21(a)(1)(i)
- Thermowells - thermowells are integral piping or tank components, and appear in the LRA Tables as "Piping," or as "Tank" component type
- Water motor alarms - water motor alarms, labeled "water gongs," provide local audible indication of fire protection deluge or alarm check valve actuation. Water gongs are independent of control room alarms, are not credited with performance of any function under 10 CFR 54.4(a), and are not within the scope of license renewal
- Filter housing - there are no filter housings that are within the boundaries of the fire protection system and subject to AMR. Numerous fire protection strainer bodies are in scope, and are listed as "Strainer body" in LRA Tables 2.3.3-18 and 3.3.2-18
- Gear box housing - all portions of gear boxes in the fire protection system are active components not subject to AMR. The diesel engine driven fire pump includes a gear box which is an integral subcomponent of the diesel driven fire pump drive train, corresponding to NEI 95-10, Appendix B, and item 55, "Fire Pump Diesel Engines". The gear box and housing is part of the active assembly, and is not subject to AMR per 10 CFR 54.21(a)(1)(i). Some manual valve or damper operators have gear boxes corresponding to NEI 95-10, Appendix B, item 108, "Manual Valves," 110, "Motor-Operated Valves," or 116, "Dampers, louvers, and gravity dampers." Only the bodies (or housings) of the actuated valves or dampers are passive and subject to AMR. The valve or damper actuators, including gear boxes, are active components not subject to AMR per 10 CFR 54.21(a)(1)(i). Gearbox housings in other systems that are associated with a separate lube oil subsystem (with a circulating pump and heat exchanger) are subject to AMR. For example, the Chemical and Volume Control System includes gear boxes within the charging pump lube oil system that are subject to AMR in LRA Tables 2.3.3-5 and 3.3.2-5

- Turbocharger housing - turbocharger housings are identified and evaluated for diesel generators in LRA Sections 2.3.3.11, 2.3.3.17, and 2.3.3.29. While the diesel driven fire pump engine has a turbocharger, the engine is a small (380 HP) unit, and the turbocharger is considered an integral part of the active engine assembly corresponding to NEI 95-10, Appendix B, item 55, “Fire Pump Diesel Engines,” and is not subject to AMR per 10 CFR 54.21(a)(1)(i)
- Latch door pull box - pull boxes are active electrical switch assemblies corresponding to NEI 95-10, Appendix B, item 102, "Switches," that are not subject to AMR per 10 CFR 54.21(a)(1)(i)
- Pneumatic actuators - pneumatic actuators in the fire protection system are active components corresponding to NEI 95-10, Appendix B, item 111, “Air-Operated Valves,” and are not subject to AMR per 10 CFR 54.21(a)(1)(i)
- Actuator housing - actuator housings in the fire protection system are considered integral parts of active components corresponding to NEI 95-10, Appendix B, item 111, “Air-Operated Valves,” and are not subject to AMR per 10 CFR 54.21(a)(1)(i)
- Dikes for oil spill confinement - “Flood curbs” are evaluated as structural commodities in LRA Tables 2.4-36 and 3.5.2-36
- Buried underground fuel oil tanks for emergency diesel generators - fuel tanks associated with diesel generators are not evaluated with the fire protection system, but with the associated diesel generator systems. Buried emergency diesel fuel tanks are listed as "Tank" in LRA Tables 2.3.3-14 and 2.3.3-29, and are evaluated as “Tank” in “Soil” in LRA Tables 3.3.2-14 and 3.3.2-29
- Fire water main loop valves - fire protection valves are labeled “Valve body” in LRA Table 2.3.3-18. Some valves include a parenthetical clarification of type; many main loop valves are buried, and are labeled “Valve body (buried)” in LRA Table 3.3.2-18. Fire water main loop valves within the Intake Structure are labeled “Valve body (water system)” in LRA Table 3.3.2-18
- Post-indicator valves - valves are labeled “Valve body” in LRA Table 2.3.3-18. Some valves include a parenthetical clarification of type; post-indicator valves are buried, and are labeled “Valve body (buried)” in LRA Table 3.3.2-18
- Jacket cooling water keepwarm pump and heater - the diesel driven fire pump engine has an electric jacket water heater, but the engine is a small (380 HP) unit, and the heater is considered an integral part of the active engine assembly, corresponding to NEI 95-10, Appendix B, item 55, “Fire Pump Diesel Engines,” and is not subject to an AMR per 10 CFR 54.21(a)(1)(i) separate from that of the engine assembly itself. AMR evaluations for the emergency diesel generators include these components, which are labeled “Pump casing” and “Heater housing” in LRA Tables 2.3.3-16 and 3.3.2-16
- Lubricating oil cooler - LRA Table 2.3.3-18 includes evaluation of the lubricating oil cooler (labeled “Heat exchanger”) for the diesel driven fire pump, which is labeled “Heat exchanger (oil cooler - housing)” and “Heat exchanger (oil cooler - tube)” in LRA Table 3.3.2-18

- Rocker lubricating oil pump - lubricating pumps for the emergency diesel generators and the security diesel generator are labeled “Pump casing” in LRA Tables 2.3.3-15, 3.3.2-15, 2.3.3-29, and 3.3.2-29
- Floor drains and curbs for fire-fighting water - floor drains are evaluated as “Piping” in LRA Tables 2.3.3-4 (Building and Yard Drains) and 2.3.3-27 (Reactor Plant Vent and Drains). “Flood curbs” are evaluated as structural commodities in LRA Tables 2.4-36 and 3.5.2-36
- Backflow prevention devices - no special name is given to piping configurations such as loop seals that prevent backflow in drain systems. The piping is labeled “Piping." Check valves are labeled “Valve body” in LRA Table 2.3.3-18, and “Valve body (CO_2/halon)” or “Valve body (water system)” in LRA Table 3.3.2-18
- Flame retardant coating for cables - Electrical cables are addressed in LRA Section 2.5. Coatings applied by manufacturers are not considered a separate component, but are evaluated and managed with the cables themselves. "Fire wraps" are used for some cable/cable tray locations and are evaluated as a structural commodity in LRA Tables 2.4-36 and 3.5.2-36
- Fire retardant coating for structural steel supporting walls and ceilings – “Fireproofing” and “Fire wraps” are evaluated as structural commodities in LRA Tables 2.4-36 and 3.5.2-36

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-10 acceptable. Although the applicant states that they consider these components to be included in other line items, the descriptions of the line items in the LRA do not specifically list all these components. The applicant properly identified the following components to be included in the other line items within the scope of license renewal and subject to an AMR: (a) hose connections; (b) interior fire hose stations; (c) pipe supports; (d) couplings; (e) threaded connections; (f) restricting orifices; (g) interface flanges; (h) chamber housing;(i) thermowells; (j) dikes for oil spill confinement; (k) buried underground fuel oil tanks; (l) fire water main loop valves; (m) post-indicator valves; (n) lubricating oil cooler; (o) rocker lubricating oil pump; (p) floor drains and curbs for fire-fighting water; (q) backflow prevention devices; (r) fire wraps; and (s) fire retardant coating for structural steel supporting walls and ceilings. The staff is assured that these components will be appropriately considered during the plant aging management activities.

For each of the following components, the staff found that they were not included in the line item descriptions in the LRA: (a) heat-actuated devices; (b) water motor alarms; (c) gear box housing; (d) latch door pull box; (e) pneumatic actuators; (f) and actuator housing. Further, the applicant has considered the turbocharger housing and jacket cooling water keepwarm pump and heater as an integral part of the active diesel driven fire pump engine assembly. Filter housings are not part of the FPS boundaries, however, fire protection strainers are identified as within the scope of license renewal and subject to an AMR. The staff recognizes the applicant’s interpretation of these components as active (short-lived components), which will result in more vigorous oversight of the condition and performance of the component. Because the applicant has interpreted that these components are active, the staff concludes that the components were correctly excluded from the scope of license renewal and are not subject to an AMR. Therefore, the staff’s concern described in RAI 2.3.3.8-10 is resolved.

The staff reviewed LRA Section 2.3.3.18 in which the applicant discussed the requirements for the fire water supply system but did not mention trash racks and traveling screens for the fire pump suction water supply. Trash racks and traveling screens are located upstream of the fire pump suction to remove any major debris from the fresh or raw water supply. Trash racks and traveling screens are necessary to remove debris from and prevent clogging of the fire protection water supply system. Trash racks and traveling screens are typically considered to be passive, long-lived components. Both trash racks and traveling screens are located in a fresh or raw water or air environment and are typically constructed of carbon steel. Carbon steel in a fresh or raw water environment or water or air environment is subject to loss of material, pitting, crevice formation, and microbiologically influenced corrosion, and fouling.

In RAI 2.3.3.18-11, dated April 17, 2008, the staff requested that the applicant explain the apparent exclusion of the trash racks and traveling screens located upstream of the fire pump suction from the scope of license renewal pursuant to 10 CFR 54.4(a) and subject to an AMR in accordance with 10 CFR 54.21(a)(1).

In its response to RAI 2.3.3.18-11, dated May 19, 2008, the applicant stated:

> The trash racks and traveling screens are within the scope of license renewal and are subject to AMR, but are not evaluated within the fire protection system. FENOC evaluated Intake Structure trash racks and traveling screens as structural components associated with the Intake Structures. While the common Intake Structure houses the fire pumps, the Alternate Intake Structure also has trash racks and traveling water screens. These components appear in LRA Tables 2.4-1, 2.4-17, 3.5.2-1 and 3.5.2-17 as “Screen guides,” “Trash racks,” and “Traveling screen casing and associated framing.” The active components of the traveling screens are not subject to AMR per 10 CFR 54.21(a)(1)(i).

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.18-11 acceptable because the applicant has evaluated trash racks and traveling screens as components associated with the intake structures in LRA Section 2.4.1. Because the applicant has committed to interpret trash racks and traveling screens as included in the intake structure system components, which is within the scope for license renewal and subject to an AMR, the staff is assured that the racks and traveling screens used for fire suppression will be appropriately considered during plant aging management activities. Also the staff has confirmed that the trash racks and traveling screens are included in LRA Tables 2.4-1, 2.4-17, 3.5.2-1, and 3.5.2-17 as “Screen guides,” “Trash racks,” and “Traveling screen casing and associated framing.” Further, the applicant has indicated that the active components of the traveling screens are not subject to AMR. Therefore, the staff’s concern described in RAI 2.3.3.18-11 is resolved.

2.3.3.18.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and all available drawings as provided by the applicant to determine whether the applicant has failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff sought to determine whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the fire protection Halon 1301, and RCP oil collection 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) and; therefore, is acceptable.

2.3.3.19 Fuel Pool Cooling and Purification System

2.3.3.19.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.19, the applicant described the safety-related fuel pool cooling and purification system, which removes heat generated by the stored spent fuel assemblies, maintains clarity of the water in the spent fuel storage pool and the refueling cavity, and makes access to the working area in and around the spent fuel storage pool possible.

The fuel pool cooling and purification system consists of two subsystems, the fuel pool cooling and the fuel pool purification subsystems. The fuel pool cooling subsystem consists of two circulating pumps, two heat exchangers, and the necessary piping and valves. The subsystem configuration can allow either pump to circulate flow through either heat exchanger to control fuel pool temperature and level.

The fuel pool purification subsystem consists of two circulating pumps, two filters, one demineralizer, and the necessary piping and valves. The subsystem configuration can allow either pump to circulate flow through either filter to:

- control the clarity and purity of the fuel pool
- support operation of the refueling cavity during refueling
- clean up the RWST
- supply emergency makeup water to the RWST

Diverse makeup sources for the spent fuel pool are available from the boron recovery system (*i.e.*, primary grade water), the SWS (Unit 2), the containment depressurization system (*i.e.*, the RWST), and the FPS (*i.e.*, via hose racks).

The fuel pool cooling and purification system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the fuel pool cooling and purification system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the fuel pool cooling and purification system performs functions that support EQ (Unit 2 only).

LRA Table 2.3.3-19 identifies fuel pool cooling and purification system component types within the scope of license renewal and subject to an AMR:

- bolting
- demineralizer
- expansion joint
- filter
- flexible hose
- heat exchanger
- orifice
- piping
- pump casing
- strainer body

- tank
- tubing
- valve body

The intended functions of the fuel pool cooling and purification system component types within the scope of license renewal include:

- restriction for flow rate limit or pressure difference
- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.19.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.19 and UFSAR Sections 9.5 and 9.1.3 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). During its review of LRA Section 2.3.3.19, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA Table 2.4-14 for the Unit 1 fuel building and LRA Table 2.4-22 for the Unit 1 reactor containment building, where the applicant has identified the spent fuel pool liner and the refueling cavity liner as subject to an AMR with the intended function of structural pressure boundary. On LRA drawing 1-20-1 for the Unit 1 fuel pool cooling and purification system, the applicant did not highlight the component spent fuel pool skimmer, 1FC-SK-1, and associated piping and refueling cavity skimmer 1FC-SK-2. Skimmers 1FC-SK-1 and 1FC-SK-2 appear to be structurally attached to the spent fuel pool liner and refueling cavity liner, respectively.

In RAI 2.3.3.19-1, dated April 17, 2008, the staff requested that the applicant justify why skimmers 1FC-SK-1 and 1FC-SK-2, and their associated piping, do not have as intended function, structural pressure boundary.

In its response to RAI 2.3.3.19-1, dated May 19, 2008, the applicant stated:

> The non safety-related fuel pool cooling and purification system spent fuel pool and refueling cavity skimmers and their flexible hoses do not have an intended function of structural pressure boundary (or leakage boundary (spatial)) because they cannot leak onto or spray nearby safety-related components, and do not provide mechanical or structural support to the pool or cavity liner. The skimmers float on the water surface and use flexible hoses to connect to non safety-related piping connections that penetrate the pool liner. The flexible hoses do not provide mechanical or structural support to the pool or cavity liner or piping.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.19-1 acceptable, because the applicant has clarified that the skimmers and attached flexible hoses do not provide a function of structural pressure boundary and are not within the scope of license renewal. The staff confirms that the skimmers and attached flexible hoses do not provide a function of structural pressure boundary and; thus, are not within the scope of license renewal and subject to an AMR. Therefore, the staff’s concern described in RAI 2.3.3.19-1 is resolved.

2.3.3.19.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff’s review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. Based on its review, the staff finds that the applicant has adequately identified the fuel pool cooling and purification system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.20 Gaseous Waste Disposal System

2.3.3.20.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.20, the applicant described the nonsafety-related GWD system, which controls, collects, processes, handles, stores, recycles, and disposes of all gaseous radioactive waste generated by plant operation. The GWD system processes and via the RMS (LRA Section 2.3.3.25), monitors all waste gas streams prior to their discharge to the atmosphere. The system allows decay-time for the degasifier gaseous effluent and for the condenser air-ejector offgas stream as necessary and recycles the hydrogen in the degasifier overheads back to the VCT. All gaseous waste effluent not recycled goes to the GWD system for disposal. The system also stores gases generated from either unit going to cold shutdown.

The failure of nonsafety-related SSCs in the GWD system could potentially prevent the satisfactory accomplishment of a safety-related function.

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

- bolting
- filter housing

- heat exchanger
- piping
- sight glass
- strainer body
- tank
- trap body
- tubing
- valve body

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

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.20.2 Staff Evaluation

The staff performed a simplified Tier 1 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.3.20.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.3.21 Liquid Waste Disposal System

2.3.3.21.1 Summary of Technical Information in the Application

The staff performed a simplified Tier 1 review of this Balance of Plant System. In LRA Section 2.3.3.21, the applicant described the nonsafety-related liquid waste disposal system (WDS), which processes liquid waste to comply with 10 CFR Part 20. The system collects, processes, and disposes of liquid radioactive waste generated by normal plant operation, including normal operational transitions. The liquid WDS consists of tanks, filters, pumps, heat exchangers, evaporators, demineralizers, piping, valves, and instrumentation necessary for operation and control. Liquid effluents in the reactor plant enter the reactor plant vent and drain system, while aerated wastes are routed to the liquid WDS. The system can process waste from either unit.

Liquid waste from building sumps must be processed with dilution, for suitability, prior to discharge into the river. The system can process liquid waste with an evaporator. However, it is not in use; thus, the system uses demineralizers.

The failure of nonsafety-related SSCs in the liquid WDS could potentially prevent the satisfactory accomplishment of a safety-related function.

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

- bolting
- demineralizer
- filter housing
- flexible hose
- heat exchanger
- heater housing
- orifice
- piping
- pump casing
- strainer body
- tank
- tubing
- valve body

The intended function of the liquid WDS component types within the scope of license renewal is to provide nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related SSCs caused by spatial interactions.

2.3.3.21.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.21 and UFSAR Sections 11.2.4 for Unit 1 and 11.2 for Unit 2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.21, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA Table 2.3.3-21, noting that the applicant listed all of the components within the scope of license renewal having an intended function of "leakage boundary (spatial)." However, on LRA drawings, 2-17-1 and 1-17-1, the applicant did not highlight several tank vents. Additionally, on LRA drawing 1-17-3, the applicant did not highlight a piping line with valve 1LW-486. These components are in the same room or building as other components in this system, which are identified as within the scope of license renewal. In RAI 2.3.3.21-1, dated April 17, 2008, the staff requested that the applicant justify the exclusion of these components from the scope of license renewal for leakage boundary.

In its response to RAI 2.3.3.21-1, dated May 19, 2008, the applicant stated that "the tank vents are not fluid-filled components, contain ambient air, and do not have the potential for spatial interaction with safety-related components. Therefore, the tank vents are not within the scope of license renewal in accordance with NEI 95-10, Appendix F, paragraph 5.2.2.1." The applicant, in its response, revised the LRA drawing 1-17-3 to include the piping line, previously not shown, as within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.21-1 acceptable because the applicant has adequately clarified that the tank vents are not within the scope of license renewal. The applicant revised the LRA drawing to include the previously not shown piping line as within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.3.21-1 is resolved.

The staff reviewed LRA drawing 1-17-2, noting that the applicant has highlighted expansion joint MEJ-LW-1 as within the scope of license renewal. However, in LRA Tables 2.3.3-21 and 3.3.2-21, the applicant did not list this component type "expansion joint;" whereas, other LRA tables include component type "expansion joint" in other systems. In RAI 2.3.3.21-2, dated April 17, 2008, the staff requested that the applicant justify the exclusion of component type "expansion joint" from the scope of license renewal in LRA Tables 2.3.3-21 and 3.3.2-21.

In its response to RAI 2.3.3.21-2, dated May 19, 2008, the applicant revised LRA Table 2.3.3-21 to include component type "expansion joint" and LRA Table 3.3.2-21 to include the aging evaluations for this expansion joint.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.21-2 acceptable because the applicant has appropriately revised the LRA to include an AMR for the expansion joint and revised the LRA tables accordingly. Therefore, the staff's concern described in RAI 2.3.3.21-2 is resolved.

2.3.3.21.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the liquid waste disposal system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.3.3.22 Post-Accident Sample System

2.3.3.22.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.22, the applicant described the post-accident sample system, which the CLB no longer credits for its sampling function. The post-accident sample system was designed to draw reactor coolant, containment atmosphere, and containment sump samples after a design-basis accident. The system is no longer credited for this function, but the equipment remains in place along with the sample piping and valves. The post-accident sample system for Unit 2 has a containment penetration that no longer supports the system sampling function.

The post-accident sample system contains safety-related components relied upon to remain functional during and following DBEs (Unit 2 only). The failure of nonsafety-related SSCs in the post-accident sample system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the post-accident sample system performs functions that support EQ.

LRA Table 2.3.3-22 identifies post-accident sample system component types within the scope of license renewal and subject to an AMR:

- bolting
- drip pan
- heat exchanger
- piping
- pump casing
- sample capsule
- sample panel
- strainer body
- tank
- tubing
- valve body

The intended functions of the post-accident sample system component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.22.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.22, UFSAR Section 12.2.1.3.3 for Unit 2, and UFSAR Table 6.2-60 for Unit 2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.22, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA Section 2.3.3.22, noting the applicant's statement that the PASS for Unit 1 contains components with a non safety-related function pursuant to 10 CFR 54.4(a)(2) and contains components relied upon to demonstrate compliance with the EQ regulation in accordance with 10 CFR 54.4(a)(3). However, the staff noted that on LRA drawing 1-14C-1, the applicant highlighted components of the post-accident sampling system (PASS) as being within the scope of license renewal. In this LRA section, the applicant stated that the PASS is no longer credited by the CLB for its sampling function. In contrast, in UFSAR Sections 11.3.3.3.27, 11.3.3.3.28, and 11.3.3.3.29 for Unit 1, the applicant described the operation and functions of PASS, which include the sampling function. In RAI 2.3.3.22-1, dated May 8, 2008, the staff requested that the applicant justify the exclusion of the PASS sampling function from the Unit 1 CLB and from the scope of license renewal.

In its response to RAI 2.3.3.22-1, dated June 9, 2008, the applicant stated that the PASS was excluded because "BVPS Unit 1 License Amendment 245 and Unit 2 Amendment 123 eliminated the requirement to have and maintain the PASS." The applicant added that "the system is no longer credited with sampling functions," although the system components have not been physically removed. The applicant clarified that the UFSAR Subsections 11.3.3.3 for Unit 1 describe the RMS rather than the PASS. The radiation monitors in UFSAR Sections 11.3.3.3.27, 11.3.3.3.28, and 11.3.3.3.29 for Unit 1 are associated with the PASS, and according to the applicant, their descriptions have not been changed in the UFSAR because the system has not been physically removed from the plant.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.22-1 acceptable because the applicant has clarified that PASS is no longer part of the CLB for Unit 1 and is not within the scope of license renewal because the requirements to have and maintain the PASS were eliminated. The staff confirms that the PASS is no longer part of the CLB for Unit 1 and is not within the scope of license renewal and; thus, not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.22-1 is resolved.

2.3.3.22.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the PASS components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.23 Post-Design Basis Accident Hydrogen Control System

2.3.3.23.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.23, the applicant described the post-DBA hydrogen control system (HCS). The 2003 revision of 10 CFR 50.44 eliminated the requirement for hydrogen recombiners and hydrogen purge systems. The recombiners are retired but some components remain, including containment penetrations and purge components. The system has redundant hydrogen analyzers with piping and valves and obtains containment samples through independent sample lines for each analyzer.

The post-DBA HCS contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the post-DBA HCS potentially could prevent the satisfactory accomplishment of a safety-related function.
In addition, the post-DBA HCS performs functions that support EQ.

LRA Table 2.3.3-23 identifies post-DBA HCS component types within the scope of license renewal and subject to an AMR:

- bolting
- expansion joint
- fan housing
- filter housing
- flexible hose
- orifice
- piping
- pump casing
- rupture disc
- tubing
- valve body

The intended functions of the post-DBA HCS component types within the scope of license renewal include:

- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.23.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.23, UFSAR Section 6.5 for Unit 1, and UFSAR Section 6.2.5 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.3.23.3 Conclusion

The staff reviewed the LRA, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the post-DBA HCS 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) and; therefore, is acceptable.

2.3.3.24 Primary Component and Neutron Shield Tank Cooling Water System

2.3.3.24.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.24, the applicant described the safety-related primary component and neutron shield tank CWS, which supplies cooling water to remove heat from reactor components during normal operations and from the RHR system heat exchangers during plant cooldown. The system also supplies normal makeup to the neutron shield expansion tank. The primary component and neutron shield tank CWS consists of three circulating pumps arranged in parallel, three heat exchangers in parallel, and the necessary piping and valves to supply cooling water to various parallel loads. Neutron shield tank cooling is performed by a natural circulation closed-loop subsystem supplied with cooling water from the main system.

The primary component and neutron shield tank CWS contains safety-related components relied upon to remain functional during and following DBEs.

The failure of nonsafety-related SSCs in the primary component and neutron shield tank CWS potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the primary component and neutron shield tank CWS performs functions that support fire protection, SBO, and EQ.

LRA Table 2.3.3-24 identifies primary component and neutron shield tank CWS component types within the scope of license renewal and subject to an AMR:

- bolting
- expansion joint
- flexible hose
- heat exchanger
- orifice
- piping
- pump casing
- sight glass
- strainer body
- tank

- tubing
- valve body

The intended functions of the primary component and neutron shield tank CWS component types within the scope of license renewal include:

- restriction for flow rate limit or pressure difference
- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.24.2 Staff Evaluation

The staff performed a detailed Tier 2 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For Staff Evaluation of this system, see Safety Evaluation Report (SER) Section 2.3

2.3.3.24.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.3.25 Radiation Monitoring System

2.3.3.25.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.25, the applicant described the safety-related RMS, which monitors process, effluent, and area radiation; and, it detects, computes, indicates, annunciates, and records, radioactivity levels. The RMS for Unit 1 has process and effluent monitors that give early warning of plant malfunctions and record and limit the discharge of radioactive fluids and gases to the environment. Area radiation monitors at fixed plant locations warn personnel of increasing radiation levels.

The RMS for Unit 2 has process, effluent, and area radiation monitors that transmit data to the digital RMS central processors in the main control room (MCR). The system initiates alarm messages when the monitored parameters exceed pre-determined reference values. Area radiation monitors at fixed plant locations warn personnel of increasing radiation levels.

The RMS contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the RMS potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the RMS performs functions that support fire protection and EQ.

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

- bolting
- filter housing
- heat exchanger
- isokinetic nozzle
- piping
- pump casing
- radiation monitor
- tubing
- valve body

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

- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention

2.3.3.25.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.25 and UFSAR Sections 11.3 for Unit 1 and 11.5, for Unit 2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.25, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA drawing 2-43-18, noting that the applicant showed the following detectors within shielded enclosures: 2HVS-RQ-109B, 2HVS-RQI-109C, 2HVS-RQ-101A, and 2HVS-RQ-101B. In UFSAR Section 11.5.2.3.2 for Unit 2, the applicant stated that an adequate amount of shielding is provided around each detector to reduce the background radiation to a level that will not interfere with detector sensitivity. The staff noted that the applicant only highlighted the shielding for detector 2HVS-RQ-101A, indicating that it is within the scope of license renewal and subject to an AMR.

In LRA Table 2.0-1, the applicant identified that the intended function of radiation shielding is to reduce neutron or gamma radiation fluence. In LRA Table 2.3.3-25, “Radiation Monitoring System Components Subject to Aging Management Review (AMR),” the applicant only identified the component type “radiation monitor” with intended functions of leakage boundary (spatial) and pressure boundary. In RAI 2.3.3.25-1, dated May 8, 2008, the staff requested that the applicant justify the exclusion of the shielded enclosures for radiation detectors 2HVS-RQ-109B, 2HVS-RQ-109C, and 2HVS-RQ-101B from the scope of license renewal with an intended function of radiation shielding.

In its response to RAI 2.3.3.25-1, dated June 9, 2008, the applicant stated that “Where radiation monitor shielding performs a function that supports the accurate detection and indication/alarm of radiation, it is considered to be an integral part of the active detector assembly.” Therefore, the radiation monitor shielding is not subject to an AMR.

The applicant explained that since “degradation of shielding would result in immediate changes in radiation monitor indication; the influence of shielding upon the function of the monitor is equivalent to that of the active electronic portion of the instrument.”

The applicant further stated that the radiation monitor flowpath for 2HVS-RQ101A, a particulate detector, has an intended function of pressure boundary, and the shielding is active and not subject to AMR. The monitor housing for 2HVS-RQ101A is highlighted as the pressure boundary. The other monitors referenced are gas monitors, which have the shielded enclosure depicted separately on the drawing.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.25-1 acceptable because the applicant has clarified that 2HVS-RQ101A was only highlighted to show the radiation monitor housing, and not the shielding, with an intended function of pressure boundary that is subject to AMR. The staff confirms that the shielded enclosures for all of the monitors were correctly excluded from the scope of license renewal because they are considered an active component; hence, they are not subject to an AMR. Therefore, the staff’s concern described in RAI 2.3.3.25-1 is resolved.

2.3.3.25.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff’s review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the RMS components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.26 Reactor Plant Sample System

2.3.3.26.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.26, the applicant described the safety-related reactor plant sample system, which transfers liquid and gaseous samples from contaminated and potentially contaminated systems, to the primary sample panel for monitoring and/or collection of grab samples or pressurized vessel samples for laboratory analysis. As part of the reactor plant sample system, the steam generator blowdown (SGB) sample system, continuously and automatically samples and monitors radiation of SGB.

The reactor plant sample system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the reactor plant sample system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the reactor plant sample system performs functions that support ATWS and EQ.

LRA Table 2.3.3-26 identifies reactor plant sample system component types within the scope of license renewal and subject to an AMR:

- bolting
- demineralizer
- flexible hose
- heat exchanger
- piping
- pump casing
- sample sink
- sight glass
- tank
- tubing
- valve body

The intended functions of the reactor plant sample system component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.26.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.26 and UFSAR Sections 9.6 for Unit 1 and 9.3.2 for Unit 2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.26, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below

The staff reviewed LRA drawing 1-14A-1 for the sampling system, noting that the applicant highlighted radiation monitor RM ISS-100 as being within the scope of license renewal for spatial concerns (*e.g*., leakage, spray, pipe whip), pursuant to 10 CFR 54.4(a)(2). The staff noted that in LRA Table 2.3.3-26, the applicant has identified the component types subject to an AMR for the reactor plant sample system. However, the staff noted that the applicant does not identify "radiation monitor" as a component type. Radiation monitors should be included within the scope of license renewal and subject to an AMR for spatial concerns pursuant to 10 CFR 54.4(a)(2) because they have an intended function of leakage boundary (spatial). In RAI 2.3.3.26-1, dated May 8, 2008, the staff requested that the applicant justify the exclusion of the radiation monitor from LRA Tables 2.3.3-26 and 3.3.2-26 as a component type requiring an AMR with an intended function of leakage boundary (spatial).

In its response to RAI 2.3.3.26-1, dated June 9, 2008, the applicant stated that the radiation monitor RM-1SS-100 "should have been shown with system boundaries to place the monitor within the scope of license renewal in the radiation monitoring system." The drawing depiction of RM-1SS-100 and several others have been revised to include all radiation monitors within the RMS as within the scope of license renewal and subject to an AMR.

The applicant included radiation monitor 2CCP-RQ100, which was also revised to show the demineralized water flush line boundary to system 32 (Water Treatment); radiation monitor 2CNA-RQ100 and its sample cooler, which was also revised to show the demineralized water flush line boundary to system 32; and radiation monitor 2SSR-RQ100. The applicant noted that all radiation monitors included within the scope of license renewal are evaluated with the RMS in LRA Section 2.3.3.25, with AMR results tabulated.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.26-1 acceptable because the applicant has revised the LRA drawings that depict the specified radiation monitors, to show that all radiation monitors in the RMS are within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.26-1 is resolved.

2.3.3.26.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions.

In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the reactor plant sample system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.27 Reactor Plant Vents and Drains System

2.3.3.27.1 Summary of Technical Information in the Application

IN LRA Section 2.3.3.27, the applicant described the safety-related reactor plant vents and drains system, which collects potentially radioactive fluids and gases from various systems and discharges them to the gaseous waste system, the liquid WDS, or the boron recovery system. The reactor plant vents and drains system consists of four subsystems; namely, two for liquids and two for gases.

The system separates liquids (drains) into those which contain air (aerated drains) and those which contain hydrogenated reactor coolant fluid (nonaerated). Nonaerated drains go to the boron recovery system for processing and reuse, while aerated drains go to the liquid WDS for disposal. The system separates gases (vents) into those which contain air (aerated vents) and those which contain hydrogen and radioactive gases (nonaerated vents). Aerated vents go to the gaseous waste dilution air subsystem. Nonaerated vents, in which hydrogen and radioactive gases predominate, go to the gaseous waste holdup subsystem. The Unit 1 system disposes of gases from both units.

The reactor plant vents and drains system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the reactor plant vents and drains system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the reactor plant vents and drains system performs functions that support fire protection and EQ.

LRA Table 2.3.3-27 identifies reactor plant vents and drains system component types within the scope of license renewal and subject to an AMR:

- bolting
- flexible hose
- heat exchanger
- piping
- pump casing
- strainer body
- tank
- trap body
- tubing
- valve body

The intended functions of the reactor plant vents and drains system component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product

- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.27.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.27 and UFSAR Sections 9.7 for Unit 1 and 9.3.3 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.27, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA drawing 2-09-3, noting that the applicant does not highlight ten tanks (shown as sumps) that house the sump pumps. The sump pumps listed by the applicant include those in the following areas: (a) north safeguards area, (b) fuel building, (c) northeast auxiliary building, (d) southeast auxiliary building, (e) west auxiliary building, (f) northwest auxiliary building, (g) tunnel, (h) decontamination building, (i) south safeguards area, and (j) gaseous waste storage vault. The staff noted that in LRA Table 2.3.3-27, the applicant has identified the component type "tank" as subject to an AMR with an intended function of leakage boundary (spatial). In RAI 2.3.3.27-1, dated May 8, 2008, the staff requested that the applicant justify the exclusion of the above tanks (sumps) from the scope of license renewal.

In its response to RAI 2.3.3.27-1, dated June 9, 2008, the applicant stated that "the tanks listed in the question are building sumps and are all within the scope of license renewal. However, because sumps are evaluated as structural components, they are not highlighted on mechanical scope drawings." The applicant listed the LRA tables where the specific sumps in the question are addressed. Also, the applicant added that stainless steel sumps were evaluated as a single bulk commodity for all sumps. The applicant added an additional row to LRA Table 3.5.2-36 in order to address exposure to a "raw water" environment for sump liners, because the table addressed the "protected from the weather" environment only for sump liners.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.27-1 acceptable because the applicant has clarified that the tanks listed are building sumps and are included in LRA Section 3.5 tables as structural components within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.3.27-1 is resolved.

2.3.3.27.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal.

The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the reactor plant vents and drains system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.28 River Water System (Unit 1 Only)

2.3.3.28.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.28, the applicant described the river water system (Unit 1), which includes the reactor plant river water system, auxiliary river water system, and the turbine plant river water system. The river water system supplies cooling water to remove heat from the power plant auxiliary systems during all modes of operation.

The reactor plant river water system consists of three safety-related river water pumps that take suction from individually screened bays within the intake structure, piping, valves, controls, electrical components, and instrumentation. Each pump is 100-percent capacity; thus, the system can have one pump out of service and still maintain two independent trains.

The nonsafety-related auxiliary river water system accommodates unit shutdown from 100-percent reactor power and subsequent RCS cooldown to cold shutdown conditions, when the intake structure is disabled.

The system has two pumps which take suction from individually screened bays within the alternate intake structure. Either pump can deliver cooling water through a common header which connects to the river water system headers downstream of the intake structure. Design and installation of the auxiliary river water system are nonsafety-related but credited with mitigation of a DBE.

The nonsafety-related turbine plant river water subsystem, which supplies cooling water from the Ohio River to secondary systems, has two pumps which take suction from individually screened bays within the intake structure. The pumps deliver cooling water to the turbine plant loads through a common header.

The river water system (Unit 1 only) contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the river water system (Unit 1 only) potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the river water system (Unit 1 only) performs functions that support fire protection, SBO, and EQ.

LRA Table 2.3.3-28 identifies river water system (Unit 1 only) component types within the scope of license renewal and subject to an AMR:

- bolting
- condenser

- expansion joint
- orifice
- piping
- pump casing
- sight glass
- strainer body
- strainer element
- tank
- tubing
- valve body

The intended functions of the river water system (Unit 1 only) component types within the scope of license renewal include:

- filtration
- restriction for flow rate limit or pressure difference
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.28.2 Staff Evaluation

The staff performed a detailed Tier 2 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.3.28.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.3.29 Security Diesel Generator System (Common)

2.3.3.29.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.29, the applicant described the nonsafety-related security diesel generator system (common), common to and used by both Units 1 and 2, and which supplies power to exterior lighting credited by regulated events. The security diesel generator supports area ingress and egress by site personnel and consists of a diesel generator, an underground fuel oil storage tank, a day tank, a fuel transfer pump, piping, and auxiliaries. Generator power is provided by a diesel engine in the guardhouse.

The fuel oil storage tank is located underground between the guardhouse and the TB for Unit 1. All other support equipment is within the guardhouse.

The security diesel generator system (common) performs functions that support fire protection and SBO.

LRA Table 2.3.3-29 identifies security diesel generator system (common) component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- flexible hose
- heat exchanger
- heater housing
- orifice
- piping
- pump casing
- tank
- turbocharger housing
- valve body

The intended functions of the security diesel generator system (common) component types within the scope of license renewal include:

- restriction for flow rate limit or pressure difference
- heat transfer
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention

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.

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

During its review of LRA Section 2.3.3.29, the staff identified areas in which additional information was necessary to complete the review of the applicant’s scoping and screening results. The applicant responded to the staff’s RAIs as discussed below.

The staff reviewed LRA Section 2.3.3.29, noting that the applicant has stated that the security diesel generator system’s intended function is to provide power to exterior lighting used for outdoor access/egress paths for Unit 1 and Unit 2. The staff further noted that on LRA drawing 1-45F-1 for the security diesel generator system, the applicant highlights the security diesel generator fuel oil tank, NHS-TK-1, and the security diesel generator fuel oil day tank, NHS-TK-2, as being within the scope of license renewal for performing an intended function pursuant to 10 CFR 54.4(a)(3). However, the applicant does not highlight the fuel oil tank fill line, vent line and flame arrestor; and the day tank vent line. The vent lines and the flame arrestor support proper functioning of the fuel oil tanks and operation of the security diesel generator. Operation of the security diesel generator is necessary in order to meet its intended function for SBO and fire protection. In RAI 2.3.3.29-1, dated May 8, 2008, the staff requested that the applicant justify the exclusion of the above mentioned components from the scope of license renewal.

In its response to RAI 2.3.3.29-1, dated June 9, 2008, the applicant stated that the "security diesel generator system fuel oil tank fill line is not in scope because its failure would not result in leakage of fuel or loss of any function." The applicant added that with regard to the tank vents, originally, these were not in-scope "because the vent lines are not expected to contain fluid, and piping integrity is not required to provide a vent." However, to ensure consistency with the presentation for other fuel oil tanks, the applicant added the security diesel generator system vent piping and flame arrestor as within the scope of license renewal.

Additionally, the applicant added the vent piping and flame arrestors for the ERF diesel generator as within the scope of license renewal, for consistency. The applicant revised the LRA and LRA boundary drawings accordingly.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.29-1 acceptable because the applicant has clarified that the fuel oil tanks fill line is not within scope because its failure would not result in fuel leakage or loss of any function. The applicant has added to the scope of license renewal, vent piping and flame arrestors, for consistency and has revised the corresponding LRA drawings and tables. Therefore, the staff's concern described in RAI 2.3.3.29-1 is resolved.

2.3.3.29.3 Conclusion

The staff reviewed the LRA, RAI responses and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the security diesel system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.30 Service Water System (Unit 2 Only)

2.3.3.30.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.30, the applicant described the safety-related SWS (Unit 2 only), which includes the standby SWS and which supplies cooling water to remove heat from the power plant auxiliary systems during all modes of operation.

The SWS consists of three safety-related pumps, piping, valves, controls, electrical components, and instrumentation. Two pumps are necessary for normal plant operation, while only one service water pump is required for safe-shutdown. The three pumps share the intake structure with the river water and turbine plant raw water pumps for Unit 1. Each service water pump is located in a separate bay of the intake structure and supplies Ohio River water to one of two supply headers.

The standby SWS accommodates unit shutdown from 100-percent reactor power and subsequent RCS cooldown to cold shutdown conditions, after the postulated loss of the intake structure. The standby SWS consists of two pumps which take suction from individually screened bays within the alternate intake structure, discharging to a common 30-inch line and connecting to the redundant 30-inch seismic Category I service water supply lines, via motor-operated valves in the seismic Category I valve pit. The standby SWS is classified as nonsafety-related, but is credited with mitigation of a DBE.

The SWS (Unit 2 only) contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the SWS (Unit 2 only) potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the SWS (Unit 2 only) performs functions that support fire protection, SBO, and EQ.

LRA Table 2.3.3-30 identifies SWS (Unit 2 only) component types within the scope of license renewal and subject to an AMR:

- bolting
- expansion joint
- flexible hose
- orifice
- piping
- pump casing
- sight glass
- strainer body
- strainer element
- tank
- tubing
- valve body

The intended functions of the SWS (Unit 2 only) component types within the scope of license renewal include:

- filtration
- restriction for flow rate limit or pressure difference
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.30.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.30 and UFSAR Sections 9.2.1.1 and 9.2.1.2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.30, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA drawings 2-30-1 for the service water pumps (2SWS-P21A, P21B, and P21C) and 2-30-1A for the standby service water pumps (2SWE-P21A and P21B), noting that the applicant has highlighted the motors, the pumps, a ¾-inch line to a pump seal, and a 1-inch pipe entering and leaving the motors. Also, the applicant has highlighted the components for performing an intended function pursuant to 10 CFR 54.4(a)(1), (a)(2), or (a)(3). The staff noted that in LRA Table 2.3.3-30, the applicant has included the component type "pump casing" and "piping" as subject to an AMR. However, in LRA Table 2.3.3-30, the applicant does not include any of the component types: "motor housing," "heat exchanger," or "pump seal cooler." The staff notes that these components are part of the cooling water supply to the service water pump motors/seals and should be within the scope of license renewal, with an intended function of "leakage boundary (spatial)." In RAI 2.3.3.30-1, dated May 8, 2008, the staff requested that the applicant justify the exclusion from LRA Table 2.3.3-30 as subject to an AMR, "motor housing" and other applicable component types serviced by this cooling water.

In its response to RAI 2.3.3.30-1, dated June 9, 2008, the applicant stated:

> The Unit 2 service water and standby service water pump motor housings are highlighted to indicate that they contain fluid-retaining components needed to support intended functions. However, the internal motor components that provide the fluid pressure boundary and heat transfer functions are not long-lived and not subject to aging management review per 10 CFR 54.21 (a)(1)(ii).

Additionally, there are no heat exchangers or other passive internal components associated with seal/bearing water supply. Each pump motor has an oil cooler supplied with service water. The coolers are replaced periodically on a 10- or 15-year frequency, as determined by site maintenance planning program. The applicant concluded that the service water lines to the motor oil coolers are within the scope of license renewal; but, the heat exchangers are not subject to an AMR, because they are not long-lived.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.30-1 acceptable because the service water pump motor oil coolers are not long-lived and are periodically replaced; hence, they are not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.30-1 is resolved.

2.3.3.30.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the SWS components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.31 Solid Waste Disposal System

2.3.3.31.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.31, the applicant described the solid WDS, which primarily collects and prepares radioactive waste materials for shipment to processing and disposal facilities. Portions of the system for Unit 2 form a safety-related piping pressure boundary for the CVCS, but the solid WDS is not credited with any other safety-related or regulated event function.

The system prepares waste streams for shipment by filtration, dewatering, solidification, segregation, compaction, packaging, storage, or a combination of methods. Materials handled as radioactive solid waste include depleted resins from process ion exchangers, concentrated waste solutions from evaporator bottoms hold tanks, spent filter cartridges, and miscellaneous contaminated or irradiated solid materials (other than fuel). Packaging, storage, and shipment of radioactive solid wastes comply with NRC and US Department of Transportation regulations.

The solid WDS immobilizes radioactive wastes in a cement mixture inside 55-gallon closed-head steel drums, a method that produces a low probability of accidental release of radioactive material to the environment during transport and storage. The waste solidification system consists of a cement storage bin and cement feeder, resin waste hold tank, evaporator bottoms hold tank, caustic buffering equipment, drumming station and drum processing enclosure, pumps, piping, valves, instrumentation, electronics, and hardware necessary for the system to function.

The system also disposes of compressible solid waste that is generated during station operation and maintenance. Compressible solid waste items are rags, anti-contamination clothing, and plastic bags. The solid waste baler is a hydraulically-operated ram that compresses the material into 55-gallon drums for eventual shipment offsite.
The solid WDS contains safety-related components relied upon to remain functional during and following DBEs (Unit 2 only). The failure of nonsafety-related SSCs in the solid WDS potentially could prevent the satisfactory accomplishment of a safety-related function.

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

- bolting
- filter housing

- flexible hose
- piping
- pump casing
- sight glass
- tank
- tubing
- valve body

The intended functions of the solid WDS component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.31.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.31 and UFSAR Sections 11.2.5 for Unit 1 and 11.4 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.31, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA drawing 1-18-1, noting that the applicant has included the note "functional locations tagged as boundary per Technical Evaluation Report (TER) 13287." In RAI 2.3.3.31-1, dated May 8, 2008, the staff requested that the applicant describe and summarize TER 13287 with respect to its relationship to license renewal boundary drawings and license renewal scoping pursuant to 10 CFR 54.4.

In its response to RAI 2.3.3.31-1, dated June 9, 2008, the applicant stated that "TER 13287 documents the formal retirement of selected equipment within the solid waste system." The applicant further explained that the non-highlighted equipment tagged in reference to TER 13287 has been formally retired, "the equipment has been isolated and drained, and the boundary valves are administratively controlled to maintain isolation." The applicant stated that the tagged equipment performs no function credited by the CLB, and does not represent a potential source of fluid or energy interaction with any safety-related components; thus, the tagged equipment is not within scope.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.31-1 acceptable because the equipment tagged in reference to TER 13287 has been formally retired, isolated, drained, and controlled such that it neither interacts with safety-related components nor performs any function credited by the CLB. Therefore, the staff's concern described in RAI 2.3.3.31-1 is resolved.

2.3.3.31.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the solid WDS components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.3.32 Supplementary Leak Collection and Release System

2.3.3.32.1 Summary of Technical Information in the Application

In LRA Section 2.3.3.32, the applicant described the safety-related supplementary leak collection and release system, which collects and filters for iodine removal, radioactive leakage from the primary containment following a DBA, prior to discharge to the atmosphere at the system vent on top of the containment building dome (elevated release). Filtering of radioactive material from the ventilation stream still occurs but is no longer credited in accident analyses. The system also controls temperature by the removal of heat from areas with safety-related equipment.
Following a loss of offsite power, the supplementary leak collection and release system fans can be powered from the emergency buses, to prevent components in these areas from exceeding design temperatures.

The supplementary leak collection and release system consists of fans, ductwork, dampers, high-efficiency particulate activity filters, charcoal filters, and I&Cs. The system fans exhaust plant areas during normal operations. The system automatically transfers ventilation flow through the filter bank on a containment isolation signal or a high-high radiation signal from monitors in the ventilation exhaust. The capacity of each exhaust fan exceeds the estimated air in-leakage to the containment contiguous area and other areas served. The excess capacity of the fan ensures a negative pressure in the exhausted areas.

The supplementary leak collection and release system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the supplementary leak collection and release system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the supplementary leak collection and release system performs functions that support fire protection and EQ.

LRA Table 2.3.3-32 identifies supplementary leak collection and release system component types within the scope of license renewal and subject to an AMR:

- bolting
- damper housing
- duct
- fan housing
- filter housing
- flexible connection
- flow straightener
- heater housing
- isokinetic nozzle
- moisture separator
- piping
- tank
- valve body

The intended functions of the supplementary leak collection and release system component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.3.32.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.32 and UFSAR Sections 6.6 for Unit 1 and 6.5.3.2 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.32, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA drawing 2-16-2, noting that the applicant has highlighted the following flow elements: (a) 2HVS-FE-22, (b) 2HVS-FE-27, (c) 2HVS-FE-26, (d) 2HVS-FE-25, and (e) 2HVS-FE-24. However, the staff noted that in LRA Table 2.3.3-32, the applicant did not list component types such as “orifice,” which would include flow elements that are subject to an AMR. In RAI 2.3.3.32-1, dated May 8, 2008, the staff requested that the applicant justify the exclusion of the component type “orifice” in LRA Table 2.3.3-32, from the scope of license renewal and subject to an AMR.

In its response to RAI 2.3.3.32-1, dated June 9, 2008, the applicant stated:

> The flow elements in the SLCRS are not orifice-type components. Ventilation flow elements in the SLCRS do not function by causing a flow restriction that produces a differential pressure between the upstream and downstream flow. Rather, these components are essentially a Section of ductwork that supports instrument piping connections for two sensing lines, one of which is exposed to total (impact) pressure by aligning the open end into the flow stream, and the other is exposed to static pressure by aligning the open end parallel to the ventilation flow stream. As such, according to the applicant, the flow element is evaluated for license renewal as component type "duct," not “orifice,” with a pressure boundary function.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.32-1 acceptable because the flow elements are not orifice-type components; they are to be evaluated as ducts. Therefore, the staff’s concern described in RAI 2.3.3.32-1 is resolved.

2.3.3.32.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal.

The staff finds no such omissions. In addition, the staff’s review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the supplementary leak collection and release system 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) and; therefore, is acceptable.

2.3.4 Steam and Power Conversion Systems

In LRA Section 2.3.4, the applicant identified 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:

- 2.3.4.1 Auxiliary Feedwater System
- 2.3.4.2 Auxiliary Steam System
- 2.3.4.3 Building Services Hot Water Heating System
- 2.3.4.4 Condensate System (Unit 1 only)
- 2.3.4.5 Glycol Heating System (Unit 1 only)
- 2.3.4.6 Main Feedwater System
- 2.3.4.7 Main Steam System
- 2.3.4.8 Main Turbine and Condenser System

- 2.3.4.9 Steam Generator Blowdown System
- 2.3.4.10 Water Treatment System

The staff's findings of LRA Sections 2.3.4.2, 2.3.4.3, 2.3.4.4, 2.3.4.5 and 2.3.4.10 were discussed and dispositioned in SER Section 2.3. The remaining sections requiring additional information to complete the review of the applicant's scoping and screening results are discussed below.

2.3.4.1 Auxiliary Feedwater System

2.3.4.1.1 Summary of Technical Information in the Application

In LRA Section 2.3.4.1, the applicant described the safety-related AFW system, an emergency source of feedwater to the steam generators. The system must ensure safe-shutdown in a main turbine trip with complete loss of normal electric power to the station, and starts automatically on a safety injection signal. Also, the AFW system (Unit 1) has a nonsafety-related dedicated AFW pump.

The AFW system at each unit consists of two motor-driven auxiliary feed pumps, a turbine-driven auxiliary feed pump, piping, valves, controls, electrical components, and instrumentation. The auxiliary feed pumps normally take suction from the primary plant demineralized water storage tank. The AFW system supply also can be provided by water from the river water system (Unit 1) or the SWS (Unit 2).

The motor-driven AFW pumps receive power from redundant 4,160 VAC emergency switchgear. The turbine-driven auxiliary feed pump steam supply is obtained from the main steam lines upstream of the steam line isolation valves.

There is a significant difference between the AFW systems for Units 1 and 2. The Unit 1 motor-driven AFW pumps and the turbine-driven pump are all located in the same area. Presumably all three pumps could be damaged by a postulated fire in this area. For this reason, a remotely-located, nonsafety-related, dedicated motor-driven AFW pump at Unit 1 can accomplish shutdown capability in the event of a fire in the AFW pump area. This additional pump can take suction from either of two tanks evaluated in the condensate system. Power for the dedicated AFW pump motor is powered from the ERF substation, which can be powered by its diesel generator. Unit 2 has no corresponding pump because the AFW pumps for this unit are not all housed in a common fire area.

The AFW system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the AFW system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the AFW system performs functions that support fire protection, ATWS, SBO, and EQ.

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

- bolting
- flexible hose
- heat exchanger

- orifice
- piping
- pump casing
- sight glass
- strainer body
- tank
- tubing
- valve body

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

- restriction for flow rate limit or pressure difference
- heat transfer
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.1 and UFSAR Sections 10.3.5.1.2, 10.3.5.2.2, 10.3.5.2.3 for Unit 1, and 10.4.9 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.4.1, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA drawing 1-24-2, noting that the applicant did not highlight the following components as within the scope of license renewal and subject to an AMR: (a) piping and valve body up to valve 351 for PI 1FW-155; (b) piping and valve body up to valve 364 for PI 1FW-156B; and (c) piping and valve body up to valve 628. These components are in the same flow paths as other components, that are highlighted as within scope and perform a similar function to those listed in LRA Table 2.3.4-1 (i.e., bolting, piping, tubing, and valve body), subject to an AMR with an intended function of pressure boundary. In RAI 2.3.4.1-1, dated

May 8, 2008, the staff requested that the applicant justify the exclusion of these components from the scope of license renewal with an intended function of pressure boundary.

In its response its response to RAI 2.3.4.1-1, dated June 9, 2008, the applicant stated that “highlighting for these components was inadvertently omitted from the original drawing.” The applicant revised the drawings to include highlighting of the piping and valve bodies noted in the RAI. The applicant noted that “additional highlighting on the LRA drawing did not affect any AMR results, and did not result in any changes to the LRA.”

Based on its review, the staff finds the applicant’s response to RAI 2.3.4.1-1 acceptable because the applicant has confirmed that it inadvertently omitted highlighting for the components from the original drawing. The applicant has revised the drawings in the LRA to include highlighting of the piping and valve bodies that are within the scope of license renewal. Therefore, the staff’s concern described in RAI 2.3.4.1-1 is resolved.

In LRA Section 2.3.4.1, the applicant stated that a separate dedicated AFW pump (FW-P-4) provides an alternate shutdown subsystem to the normal AFW system, in the event of a fire in the AFW pump area. The staff noted that on LRA drawing 1-24-3, the applicant has highlighted the flow path from turbine plant demineralized water tank WT-TK-11 to where the 4-inch dedicated AFW pump line ties into the 26-inch MFW line at location D-9, as within the scope of license renewal. The staff also noted that on drawing 1-24-3, the applicant did not highlight components upstream on the main feedwater (MFW) header, where the alternate AFW piping connection ties into the header, at location D-9 (*e.g.*, MFW piping, feedwater pump check valves, and first point feedwater heaters).

In order for the dedicated AFW system for Unit 1 to meet its intended fire protection function of providing water to the steam generators in the event of a fire pursuant to 10 CFR 54.4(a)(3), that disables the primary AFW system pumps, the flow path must be capable of delivering the water to the steam generators. If there is a rupture of MFW piping between the MFW check valves (FW-001 and FW-002) and the piping junction of the four-inch dedicated AFW pump line, flow cannot be delivered to the steam generators. Additionally, on Figure 4-4 of the Unit 1, Appendix R Report, the applicant showed the feedwater system Appendix R safe-shutdown flow path. On Figure 4-4, the MFW pump check valves (FW-001 and FW-002) are shown as providing isolation for the dedicated AFW pump flow path to the steam generators. In RAI 2.3.4.1-2, dated May 8, 2008, the staff requested that the applicant justify the exclusion of the MFW piping and components between the dedicated AFW pump pipe line to MFW line connection up to and including the MFW pump check valves (FW-001 and FW-002), from the scope of license renewal.

In its response to RAI 2.3.4.1-2, dated June 9, 2008, the applicant stated that originally, only the direct flowpath required for compliance with 10 CFR 54.4(a)(3) functions associated with the dedicated AFW pump was scoped in. The applicant revised the LRA and expanded the scope for this (a)(3) function to include branch lines of up to and including the first isolation valve from the flowpath, and upstream from the MFW header to the MFW pump discharge check valves. The applicant revised LRA drawings 1-22-1, 1-24-1, 1-24-3, and 1-32-7 to highlight these branch lines in red to indicate that they are included within the scope of license renewal, pursuant to 10 CFR 54.4(a)(3). Additionally, the applicant stated that the scope expansion resulted in the addition of the first point feedwater heaters into scope “Heat exchanger (tube),” “heat exchanger (channel),” and “heat exchanger (tubesheet)” component types were added as within scope for the MFW system as pressure boundary components. The applicant has revised LRA Tables 2.3.4-6 and 3.4.2-6 to include new rows for these heat exchanger components.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.1-2 acceptable because the applicant revised the LRA to include the MFW piping and components between the dedicated AFW pump pipe line to MFW line connection up to and including the MFW pump check valves. Therefore, the staff's concern described in RAI 2.3.4.1-2 is resolved.

2.3.4.1.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff found instances where the applicant omitted structures that should have been included within the scope of license renewal. The applicant has satisfactorily resolved the issues as discussed in the preceding staff evaluation. The staff finds no further omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no further omissions.

Based on its review, the staff finds that the applicant has adequately identified the AFW system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.4.2 Auxiliary Steam System

2.3.4.2.1 Summary of Technical Information in the Application

In LRA Section 2.3.4.2, the applicant described the auxiliary steam system, which supplies heating and process steam for nonsafety-related use in various balance-of-plant and primary plant support systems and recovers the condensed steam from the equipment supplied. The system can supply steam during normal operation, plant start-up, and plant shutdown.

The auxiliary steam system receives its steam supply from the MSS (when the reactor plant is in operation), from the opposite unit's auxiliary steam system (when the supplied unit shuts down), or from the Unit 2 auxiliary boilers. Unit 1 has no auxiliary boilers. A condensate receiver and condensate pumps collect condensate from the components served.

The collected condensate may return to either unit. The system continuously monitors auxiliary steam condensate for radioactivity, to detect leakage from radioactive systems into the auxiliary steam system. The only safety-related auxiliary steam system components are the safety-related auxiliary steam system isolation valves, which automatically isolate on a HELB in selected areas. The auxiliary steam system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the auxiliary steam system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the auxiliary steam system performs functions that support EQ.

LRA Table 2.3.4-2 identifies auxiliary steam system component types within the scope of license renewal and subject to an AMR:

- bolting

- flexible hose
- heat exchanger
- orifice
- piping
- pump casing
- sight glass
- strainer body
- tank
- trap body
- tubing
- valve body

The intended functions of the auxiliary steam system component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.4.2.2 Staff Evaluation

The staff performed a detailed Tier 2 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.4.2.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.4.3 Building Services Hot Water Heating System

2.3.4.3.1 Summary of Technical Information in the Application

In LRA Section 2.3.4.3, the applicant described the nonsafety-related building services hot water heating system, which supplies chemically-treated hot water to various unit heaters and heating coils in air-handling units and ductwork. In addition, at Unit 1, the system supplies the glycol heating system heat exchangers.

Not credited for any safety-related function or regulated event, the building services hot water heating system consists of pumps, heat exchangers, piping, tanks, valves, controls, electrical components, and instrumentation. The hot water heating piping system consists of several branches, some of which supply areas with safety-related equipment.

The failure of nonsafety-related SSCs in the building services hot water heating system could potentially prevent the satisfactory accomplishment of a safety-related function. LRA Table 2.3.4-3 identifies building services hot water heating system component types within the scope of license renewal and subject to an AMR:

- bolting
- heat exchanger
- heating coil
- orifice
- piping
- pump casing
- sight glass
- strainer body
- tank
- trap body
- tubing
- valve body

The intended function of the building services hot water heating system component types within the scope of license renewal is to provide nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions.

2.3.4.3.2 Staff Evaluation

The staff performed a simplified Tier 1 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.4.3.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.4.4 Condensate System (Unit 1 Only)

2.3.4.4.1 Summary of Technical Information in the Application

In LRA Section 2.3.4.4, the applicant described the nonsafety-related condensate system (Unit 1 only), which removes condensate from the main condenser hotwell and supplies preheated water to the suction of the MFW pumps. The system cools the SGB heat exchanger, condenser air ejectors, and gland steam condensers. From the gland steam condensers, condensate flows through two parallel feedwater heater trains, each consisting of one heater drain cooler and five low-pressure feedwater heaters. The flow from the last low-pressure feedwater heater combines with that from the other train to the common suction line of the MFW pumps.

The condensate system is within the scope of license renewal only for its support of the nonsafety-related dedicated AFW pump, to which the system supplies water from plant demineralized water storage tanks. The Unit 1 motor-driven AFW pumps and turbine-driven pump are located in the same area. Presumably all three pumps could be damaged by a postulated fire in this area. For this reason, a remotely-located, dedicated motor-driven auxiliary feed pump at Unit 1 can accomplish shutdown capability in a postulated fire in the AFW pump area. Unit 2 has no corresponding pump because the Unit 2 AFW pumps are not all housed in a common fire area. The condensate system (Unit 1 only) performs functions that support fire protection.

LRA Table 2.3.4-4 identifies condensate system (Unit 1 only) component types within the scope of license renewal and subject to an AMR:

- bolting
- piping
- tank
- valve body

The intended function of the condensate system (Unit 1 only) component types within the scope of license renewal is to provide pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention.

2.3.4.4.2 Staff Evaluation

The staff performed a simplified Tier 1 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.4.4.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.4.5 Glycol Heating System (Unit 1 Only)

2.3.4.5.1 Summary of Technical Information in the Application

In LRA Section 2.3.4.5, the applicant described the nonsafety-related, building services glycol heating system (Unit 1), which supplies heating solution to ventilation and air conditioning units utilizing outside air. This closed, forced system consists of heat exchangers, circulating pumps, piping, valves, and heating coils. An aqueous solution of ethylene glycol circulates through preheat coils and heating coils to prevent coil freeze-up in heating and ventilating and air conditioning units utilizing outside air. The glycol solution piping consists of two piping loops; namely, one supplying selected heating coils in the auxiliary building and the other, selected heating coils in the service building.

The failure of nonsafety-related SSCs in the glycol heating system (Unit 1 only) could potentially prevent the satisfactory accomplishment of a safety-related function.

LRA Table 2.3.4-5 identifies glycol heating system (Unit 1 only) component types within the scope of license renewal and subject to an AMR:

- bolting

- heat exchanger
- heating coil
- orifice
- piping
- pump casing
- sight glass
- strainer body
- tank
- tubing
- valve body

The intended function of the glycol heating system (Unit 1 only) component types within the scope of license renewal is to provide nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions.

2.3.4.5.2 Staff Evaluation

The staff performed a simplified Tier 1 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.4.5.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.4.6 Main Feedwater System

2.3.4.6.1 Summary of Technical Information in the Application

In LRA Section 2.3.4.6, the applicant described the MFW system, which supplies feedwater to the three steam generators using two half-size, motor-driven MFW pumps for the necessary flow and pressure. Unit 2 also has a motor-driven start-up feedwater pump that minimizes operation of the MFW pumps at low flow during start-up and low load operation. The start-up feedwater pump can operate in parallel with one MFW pump if the other is out of service.

The MFW pumps discharge through two half-size, high-pressure feedwater heaters arranged in parallel to a common discharge header for distribution to the steam generators. Feedwater flows to each steam generator through individual feedwater flow control valves, each positioned by a three-element feedwater control system. When feedwater flow requirements are low, a bypass valve around each feedwater control valve, controls steam generator level and feedwater flow. The feedwater isolation valves, control valves, and control valve bypass valves automatically close on a feedwater isolation signal, to isolate MFW flow to the steam generators.

The MFW system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the MFW system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the MFW system performs functions that support fire protection, ATWS, SBO, and EQ.

LRA Table 2.3.4-6 identifies MFW system component types within the scope of license renewal and subject to an AMR:

- bolting
- flexible hose
- orifice
- piping
- tubing
- valve body

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

- restriction for flow rate limit or pressure difference
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.4.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.6 and UFSAR Sections 10.3.5 for Unit 1 and 10.4.7 for Unit 2, using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.4.6, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA drawing 2-24-2A, noting that the applicant has shown the MFW regulating valves and bypass valves for Unit 2 as highlighted in blue, indicating that these valves are within the scope of license renewal pursuant to 10 CFR 54.4(a)(2). In LRA Section 2.3.4.6, the applicant stated that feedwater isolation valves, control valves, and control valve bypass valves will automatically close on receipt of a feedwater isolation signal, to isolate MFW flow to the steam generators. In UFSAR Section 15, the applicant also stated that the MFW control and bypass valves are required to close, following a main steam line break. In LRA Section 2.0, the applicant further stated, "The BVPS license renewal review methods are consistent with the approach recommended in Nuclear Energy Institute document NEI 95-10, Industry Guidelines for Implementing the Requirements of 10 CFR 54 - The License Renewal Rule, Revision 6." The staff noted that in accordance with NEI 95-10, these valves provide an isolation function and perform a safety-related function; therefore, they should be included within the scope of license renewal pursuant to 10 CFR 54.4(a)(1). In RAI 2.3.4.6-1, dated May 8, 2008, the staff requested that the applicant include the main and bypass feedwater regulating valves within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) or justify their exclusion. The staff also requested that the applicant evaluate the attached piping and supports, along with surrounding components, for inclusion within the scope of license renewal pursuant to 10 CFR 54.4(a)(2).

In its response to RAI 2.3.4.6-1, dated June 9, 2008, the applicant stated that "the Unit 2 main and bypass FRVs are classified as safety-related in the plant equipment database and should be included within scope for license renewal in accordance with 10 CFR 54.4(a)(1)." The applicant will revise LRA drawing 2-24-2A to highlight the valves in red to show they are within the scope of license renewal pursuant to 10 CFR 54.4(a)(1). Additionally, the applicant clarified that "piping on either side of the valves is not safety-related, but the piping located in the service building is included within scope for 10 CFR 54.4(a)(2) only."

The applicant replied that, in UFSAR Section 10.4.7.3 for Unit 2, the feedwater regulating valves (also referred to as control valves) along with the redundant feedwater isolation valves are credited for the feedwater isolation function. Further, the applicant confirmed that the feedwater regulating valves, the feedwater regulating valve bypasses, and the feedwater isolation valves receive redundant ESF signals from diverse trains upon a feedwater isolation signal. The applicant stated that the feedwater isolation valves are located in the safety-related main steam valve area with seismic category I supports. The feedwater regulating valves and feedwater regulating valve bypass valves are located in the service building, attached to non nuclear safety class piping and supports that are seismically-supported. All of the attached piping and supports within the service building are within the scope of license renewal under 10 CFR 54.4(a)(2).

The applicant stated that the feedwater regulating valves and bypass feedwater regulating valves do not perform any other safety-related function. A failure of these feedwater lines will not prevent the feedwater isolation function; therefore, failure of directly connected piping or nonseismic supports in the TB will not prevent satisfactory accomplishment of any safety-related function. Hence, no directly-connected piping in the TB, related to the feedwater regulating valves, was added as within the scope of license renewal, pursuant to 10 CFR 54.4(a)(2).

In its response, the applicant restated that its applied scoping method included liquid and steam retaining components in safety-related structures within the scope of license renewal. The service building for Unit 2 is a safety-related structure, and all liquid and steam retaining components in the building are within scope. No additional components in the service building were added to scope pursuant to 10 CFR 54.4(a)(2), due to the evaluation that the feedwater regulating valves are safety-related components.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.6-1 acceptable because the applicant described that the Unit 2 feedwater regulating valves and bypass feedwater regulating valves are safety-related and are within the scope of license renewal in accordance with 10 CFR 54.4(a)(1), and the attached piping and supports, and/or surrounding components are not safety-related but within scope pursuant to 10 CFR 54.4(a)(2). Therefore, the staff's concern described in RAI 2.3.4.6-1 is resolved.

The staff reviewed LRA drawing 1-24-1, noting that the applicant has shown feedwater regulating valves and bypass feedwater regulating valves for Unit 1 as highlighted in red, which corresponds to components that are credited by the CLB for performing an intended function in accordance with 10 CFR 54.4(a)(1), (a)(2), or (a)(3). This flow path is coincidental with an (a)(3) flow path. In RAI 2.3.4.6-2, dated May 8, 2008, the staff requested that the applicant verify that these valves are within the scope of license renewal for 10 CFR 54.4(a)(1).

In its response, dated June 9, 2008, the applicant stated:

> The Unit 1 main and bypass feedwater regulating valves are classified as safety-related in the plant equipment database, and are in scope for license renewal in accordance with 10 CFR 54.4(a)(1). The piping on either side of the valves, however, is not safety-related, and is in scope for regulated event flowpath only. LR Drawing 1-24-1 has been revised to clearly depict the safety-related boundaries at these valves, and to show the (a)(2) directly-connected scoping boundaries (equivalent anchor locations) associated with the safety / nonsafety transitions. The equivalent anchor evaluation did not result in additional piping being added to scope beyond the piping that is credited with a pressure boundary function.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.6-2 acceptable because the applicant clarified that the Unit 1 feedwater regulating valves and feedwater regulating valve bypasses are within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) and their equivalent anchor evaluation did not require any additional piping to be brought into scope. Therefore, the staff's concern described in RAI 2.3.4.6-2 is resolved.

2.3.4.6.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff found instances where the applicant omitted systems and structures that should have been included within the scope of license renewal. The applicant has satisfactorily resolved the issues as discussed in the preceding staff evaluation. The staff finds no further omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no further omissions.

Based on its review, the staff finds that the applicant has adequately identified the MFW system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.4.7 Main Steam System

2.3.4.7.1 Summary of Technical Information in the Application

In LRA Section 2.3.4.7, the applicant described the MSS, which supplies dry saturated steam to the main turbine, the turbine steam bypass system, the gland sealing system, the auxiliary steam system, the moisture separator reheaters, and the turbine-driven AFW pump. Safety-related portions of the MSS remove reactor decay heat for reactor plant cooldown.

The system routes steam from each of the three steam generators through the containment wall to the main steam valve area, which houses the steam generator safety valves, main steam trip and non-return valves (Unit 1) or main steam isolation valves (Unit 2), atmospheric steam dump valves, and a single common residual heat release valve. Each main steam line in the main steam valve area also supplies the turbine-driven AFW pump. The three main steam lines join a main steam header in the TB just below the mezzanine level.

Bypass valves around each main steam trip valve (Unit 1) or main steam isolation valve (Unit 2), normally are closed during power operation. During plant heat-up the valves assist in warming up and pressurizing the downstream main steam piping. The main steam header distributes steam to systems in the TB. Four lines route to the high-pressure turbine throttle valves, two lines route to the turbine steam bypass (steam dump) system, and individual lines supply the gland sealing and auxiliary steam systems. Two reheater steam supply lines tap off of the two steam dump lines.
The atmospheric steam dump valves, one on each of the three main steam lines upstream of each main steam trip and non-return valve (Unit 1) or main steam isolation valve (Unit 2), are used for: (a) plant cooldown when the main condenser is unavailable, (b) relief of excess pressure in the steam generators, and (c) prevention of unwanted lifting of the safety valves.

The residual heat release valve can remove all sensible and core decay heat one-half hour after a reactor trip, when the main condenser is not available. The steam flow is from the valve through the residual heat release header to atmosphere. This one valve, mounted on the common residual heat release header, serves all three steam generators through connections on each main steam line upstream of the main steam trip valves (Unit 1) or main steam isolation valves (Unit 2). A check valve in each residual heat release line ensures steam flow to the header but prevents reverse flow if a line breaks between a steam generator and a main steam trip valve (Unit 1) or main steam isolation valve (Unit 2).

The condenser steam dump system consists of 18 valves capable of dumping steam to the condenser as necessary and is configured so nine valves dump to each condenser half. Upon loss of load to the main turbine generator, the steam dump system automatically bypasses excess steam from the steam generators directly to the main condenser, and controls the amount of flow through the steam dumps based on reactor coolant average temperature. The steam dump system also maintains constant steam pressure in the main steam header during plant startup, testing, and shutdown.

A flow restrictor in each steam generator exit nozzle limits steam flow in a steam line break downstream of the flow restrictor, limiting the RCS cooldown rate and reactivity addition to the reactor core.

The MSS contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the MSS potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the MSS performs functions that support fire protection, ATWS, SBO, and EQ.

LRA Table 2.3.4-7 identifies MSS component types within the scope of license renewal and subject to an AMR:

- bolting
- flexible hose
- orifice
- piping
- trap body
- tubing
- turbine casing
- valve body

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

- restriction for flow rate limit or pressure difference
- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.4.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.7 and UFSAR Sections 10.3.1.2 for Unit 1 and 10.3.2 for Unit 2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). During its review of LRA Section 2.3.4.7, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA drawing 1-21-1, noting that the applicant has highlighted the 32-inch main steam headers in the service building up to an equivalent anchor location that appears to be short of the service building/TB boundary. In LRA Section 2.4.26, the applicant has stated that the Unit 1 service building is included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). In LRA Section 2.1.1.2.3, the applicant has also stated that fluid-retaining (*i.e.*, water, steam, oil or hydraulic liquids) nonsafety-related systems and components that are located inside safety-related structures, are included within the scope of license renewal for potential spatial interaction pursuant to 10 CFR 54.4(a)(2). The staff noted that since the Unit 1 service building is safety-related, the whole length of the 32-inch main steam headers in the service building should be within the scope of license renewal and subject to an AMR for potential spatial interaction, in accordance with 10 CFR 54.4(a)(2). In RAI 2.3.4.7-1, dated May 8, 2008, the staff requested that the applicant verify that the whole 32-inch main steam piping is highlighted in the service building as included within the scope of license renewal, or justify its exclusion from the scope of license renewal and subject to an AMR.

In its response to RAI 2.3.4.7-1, dated June 9, 2008, the applicant stated that "the entire length of main steam piping within the service building is within the scope of license renewal." The applicant revised the relevant LRA drawing to "more clearly depict the scoping endpoint at the service building boundary."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.7-1 acceptable because the applicant has clarified that the whole 32-inch main steam piping is within the scope of license renewal and has revised the LRA drawings accordingly. Therefore, the staff's concern described in RAI 2.3.4.7-1 is resolved.

2.3.4.7.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff finds that the applicant has adequately identified the MSS components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.4.8 Main Turbine and Condenser System

2.3.4.8.1 Summary of Technical Information in the Application

In LRA Section 2.3.4.8, the applicant described the main turbine and condenser system and auxiliaries, which utilize steam from the nuclear steam supply system as the motive force for the main unit generator of electrical power on the system grid. The main turbine portion of the system consists of an 1,800-rpm, tandem, compound main turbine unit with one double-flow, high-pressure turbine and two double-flow low-pressure turbine sections, four high-pressure inlet throttle valves, four high-pressure inlet governing valves, four moisture separator reheaters, four low-pressure reheat stop valves, four low-pressure interceptor valves, an electro-hydraulic control system, provisions for extracting steam for feedwater heating, a gland steam sealing system, a turbine lube oil system, and an auto-stop oil system. Other portions of the main turbine and condenser system include the main condenser and air ejectors and the miscellaneous vents and drain system.

The system admits steam from the MSS through four steam lines, each with a throttle valve, then supplies the steam through individually-controlled, hydraulically-operated governor valves to the high-pressure turbine. Steam passes from the high-pressure turbine casing into the moisture separator reheaters. High pressure steam from the main steam header is the heating steam in the moisture separator reheaters.

Dry superheated steam (at full load) exits the moisture separator reheaters through reheat stop valves and intercept valves, enters the two low-pressure turbines, and passes from them to the condenser.

To prevent the leakage of air into or steam out of the turbine casing along the shaft, each turbine Section has labyrinth-type steam gland seals supplied with steam from the gland sealing steam system.

Journal bearings, two for each turbine, support the turbine shaft. A thrust bearing, mounted between the two low-pressure turbines, accomplishes axial positioning of the shaft.
Oil is supplied to the turbine bearings from the turbine lubricating oil system, the oil output of which cools and lubricates the turbine bearings, acts as a control medium in the turbine protection (auto-stop oil) system to effect various turbine trips, and backs up the generator seal oil system upon failure of both air side seal oil pumps.

The hydraulic auto-stop oil system initiates a turbine trip when required. The auto-stop oil system trip signal causes a loss of electro-hydraulic fluid system pressure and closure of all turbine throttle, governor, interceptor, and reheat stop valves.

The system diverts the Unit 1 air ejector exhaust from the gaseous waste system to the reactor containment upon a signal from an in-line radiation monitor. This line has a containment isolation function (Unit 1).

The main turbine and condenser system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the main turbine and condenser system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the main turbine and condenser system performs functions that support ATWS and EQ.

LRA Table 2.3.4-8 identifies main turbine and condenser system component types within the scope of license renewal and subject to an AMR:

- bolting
- moisture separator
- piping
- trap body
- valve bodies

The intended functions of the main turbine and condenser system component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention

- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.4.8.2 Staff Evaluation

The staff performed a detailed Tier 2 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant's scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.4.8.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

2.3.4.9 Steam Generator Blowdown System

2.3.4.9.1 Summary of Technical Information in the Application

In LRA Section 2.3.4.9, the applicant described the SGB system, which primarily removes contaminants and process blowdown water from the steam generators to maintain steam generator water chemistry within specified limits. Continuous blowdown of the steam generators is necessary during operation because the boiling action concentrates the chemicals and impurities introduced into the steam generators from the feedwater. Portions of the system are safety-related. The SGB system consists of containment isolation valves, a blowdown flash tank, tanks, pumps, piping, heat exchangers, filters, demineralizers, resin traps, valves, and instrumentation.

Blowdown flow rate regulation is accomplished by adjusting hand control valves. The system normally directs steam in the blowdown flash tank to feedwater heaters. Blowdown flash tank level control is accomplished by a level control valve. The blowdown water flows through heat exchangers, filters, and demineralizers prior to returning to the main condenser. Radiation monitors continuously sample the flow path to indicate any potential steam generator tube leak.

Safety-related containment isolation valves perform a containment isolation function of isolating SGB flow in a HELB outside containment or actuation of the AFW pumps. Additionally, high steam generator sample radiation or high blowdown tank level will isolate blowdown flow (Unit 2).

The SGB system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the SGB system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the SGB system performs functions that support ATWS and EQ.

LRA Table 2.3.4-9 identifies SGB system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- flexible hose
- heat exchanger
- orifice

- piping
- pump casing
- tank
- tubing
- valve body

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

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.4.9.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.9 and UFSAR Sections 10.3.8 for Unit 1 and 10.4.8 for Unit 2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1). During its review of LRA Section 2.3.4.9, the staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

The staff reviewed LRA Section 2.3.4.9, noting that the applicant has stated that an intended function of the SGB system is that it contains components relied upon in the safety analyses or plant evaluations to demonstrate compliance with EQ regulations. In UFSAR Section 10.3.8.3 for Unit 1, the applicant identified the following feature, "Reducing orifices (RO-BD-109A, B, and C) limit the energy release in those areas without ambient monitors so the environmental qualification envelope in those areas with vital equipment is maintained."

In LRA Table 2.3.4-9, the applicant identified the component type "orifice" as being subject to an AMR with an intended function of leakage boundary (spatial). However, the staff noted that on LRA drawing 1-25-1, at locations A-6 and B-6, the applicant did not highlight these orifices as within the scope of license renewal pursuant to 10 CFR 54.4(a)(3), which includes the above identified function. In RAI 2.3.4.9-1, dated May 8, 2008, the staff requested that the applicant justify the exclusion of these orifices from the scope of license renewal.

In its response to RAI 2.3.4.9-1, dated June 9, 2008, the applicant stated:

> The LRA did not originally include restricting orifices RO-BD-109A, -109B, and -109C within the scope of license renewal. Since Unit 1 UFSAR Section 10.3.8.3 identifies these orifices as performing a function associated with EQ, these orifices were added to scope for 10 CFR 50.54(a)(3) with a component intended function of "Flow restriction." The applicant revised the relevant drawing to show RO-BD-109A, -109B, and -109C highlighted in red. The component function "Flow restriction" was added to the orifice component in the relevant LRA table. The applicant explained that these components are located on the roof of the service building (outside), and five new rows were added to the relevant AMR table to account for these components. Additionally, the "Air-outdoor" environment was added to the list of environments for the SGB system in LRA Section 3.4.2.1.9.

Based on its review, the staff finds the applicant's response to RAI 2.3.4-9-1 acceptable because the applicant has clarified that the orifices perform a function associated with EQ and; thus, are within the scope of license renewal. Additionally, the applicant has revised the LRA drawing and table, accordingly. Therefore, the staff's concern described in RAI 2.3.4-9-1 is resolved.

2.3.4.9.3 Conclusion

The staff reviewed the LRA, RAI responses, UFSAR, and drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff found instances where the applicant omitted systems and structures that should have been included within the scope of license renewal. The applicant has satisfactorily resolved the issues as discussed in the preceding staff evaluation. The staff finds no further omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no further omissions.

Based on its review, the staff finds that the applicant has adequately identified the SGB system components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.3.4.10 Water Treatment System

2.3.4.10.1 Summary of Technical Information in the Application

In LRA Section 2.3.4.10, the applicant described the nonsafety-related water treatment system, which performs the following:

- Clarifies and filters Ohio River water
- Demineralizes a portion of the filtered water
- Produces reactor-grade demineralized water
- Stores sufficient filtered and demineralized water

- Neutralizes wastes to generate an effluent with a pH of 6.0 to 9.0 before discharge to the cooling tower blowdown stream

The main water treatment processing facility is located at Unit 1, where the system clarifies, filters, and demineralizes river water. Normal production of demineralized water is accomplished by pumping filtered water through a vendor-supplied demineralizer skid. The water treatment area has, but normally does not use, installed demineralizers and regeneration equipment.

The system then distributes filtered and demineralized water from the Unit 1 processing facility to Units 1 and 2.
The most significant recipient of demineralized water is the primary plant demineralized water storage tank, which supplies the AFW pumps. The water treating systems at both units have the tanks, pumps, piping, valves, controls, and instrumentation to store, distribute, and chemically adjust demineralized and filtered water as required for primary and secondary plant make-up, cooling water make-up, and general plant use. Operation of the water supply and treatment system is not necessary for safety and there is no redundancy of equipment.

The failure of nonsafety-related SSCs in the water treatment system could potentially prevent the satisfactory accomplishment of a safety-related function. The water treatment system also performs functions that support fire protection (Unit 2 only).

LRA Table 2.3.4-10 identifies water treatment system component types within the scope of license renewal and subject to an AMR:

- bolting
- piping
- sight glass
- tank
- tubing
- valve body

The intended functions of the water treatment system component types within the scope of license renewal include:

- nonsafety-related maintenance of mechanical and structural integrity to prevent failure of safety-related structures, systems, and components caused by spatial interactions
- pressure-retaining boundary for delivery of sufficient flow at adequate pressure (and barrier to fire spread for components like ductwork and fire dampers), fission product barrier for containment pressure boundary, or containment isolation for fission product retention
- nonsafety-related maintenance of mechanical and structural integrity for support of attached safety-related piping and components

2.3.4.10.2 Staff Evaluation

The staff performed a detailed Tier 2 review of this Balance of Plant System and required no specific additional information to complete its review of the applicant’s scoping and screening results. For the staff evaluation of this system, see SER Section 2.3.

2.3.4.10.3 Conclusion

For staff conclusion for this system, see SER Section 2.3.

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 discusses:

- alternate intake structure (common)
- auxiliary building
- boric acid tank building (Unit 1 only)
- cable tunnel
- chemical addition building (Unit 1 only)
- condensate polishing building (Unit 2 only)
- control building (Unit 2 only)
- decontamination building
- diesel generator building
- emergency outfall structure (Unit 2 only)
- emergency response facility diesel generator building (common)
- emergency response facility substation building (common)
- equipment hatch platform
- fuel building
- gaseous waste storage vault
- guard house (common)
- intake structure (common)
- main steam and cable vault
- pipe tunnel
- primary demineralized water storage tank pad and enclosure
- primary water storage building (Unit 1 only)
- reactor containment building
- refueling water storage tank and chemical addition tank pad and surroundings
- relay building (common)
- safeguards building
- service building
- solid waste building (Unit 1 only)
- south office and shops building (common)
- steam generator drain tank structure (Unit 1 only)
- switchyard (common)
- turbine building
- valve pit
- waste handling building (Unit 2 only)
- water treatment building (Unit 1 only)
- yard structures
- bulk structural commodities

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

The staff's evaluation of the information in the LRA was performed in the same manner for all structures. The objective was to determine whether the applicant has identified, in accordance with 10 CFR 54.4, components and supporting structures for those structures that appear to meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived SCs were subject to an AMR in accordance with 10 CFR 54.21(a)(1).
In its scoping evaluation, the staff reviewed the applicable LRA sections, focusing on components that have not been identified as within the scope of license renewal. The staff reviewed the UFSAR, for each structure to determine whether the applicant has omitted from the scope of license renewal, components with intended functions pursuant to 10 CFR 54.4(a). The staff also reviewed the UFSAR to determine whether the LRA specified all intended functions in accordance with 10 CFR 54.4(a). The staff requested additional information to resolve any identified omissions or discrepancies.

After its review of the scoping results, the staff evaluated the applicant's screening results. For those SCs with intended functions, the staff sought to determine whether (1) the functions are performed with moving parts or a change in configuration or properties or (2) the SCs are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those SCs meeting neither of these criteria, the staff sought to confirm whether they were subject to an AMR, as required by 10 CFR 54.21(a)(1). The staff requested additional information to resolve any omissions or discrepancies identified.

2.4.1 Alternate Intake Structure (Common)

2.4.1.1 Summary of Technical Information in the Application

In LRA Section 2.4.1, the applicant described its non-QA Category I alternate intake structure. This structure is common to both Units 1 and 2; and, is seismically designed and classified as augmented quality. Located east of the plant and east of the Shippingport Bridge, this approximately 60 by 42 by 62 feet high structure houses the Unit 1 auxiliary river water and the Unit 2 standby SWSs, which provide heat sink requirements after a postulated loss of the seismic Category I intake structure.

The periphery of the alternate intake structure is a cofferdam formed by sheet piling driven to refusal on bedrock. Sheet piling driven on the north-south centerline of the periphery forms two separate cells which are the river water bays from which the standby service water and auxiliary river water pumps take suction. Above the reinforced concrete operating floor, the structure is steel framed and enclosed with insulated metal siding and roof decking. Extending away from the sheet piling on the south side of the structure is a reinforced concrete pipe chamber. Embedded within the lower concrete floor and supporting the pipe chamber are steel H-piles driven to refusal.

The failure of nonsafety-related SSCs in the alternate intake structure (common) could potentially prevent the satisfactory accomplishment of required safety-related functions.

LRA Table 2.4-1 identifies alternate intake structure (common) component types within the scope of license renewal and subject to an AMR.

2.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.4.1 and UFSAR 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 2.4.1, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the alternate intake structure.

Therefore, the staff issued RAIs to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAIs related to LRA Section 2.4.1, the corresponding applicant responses, and the staff evaluation.

In RAI 2.4.XX-1, dated June 4, 2008, the staff requested that the applicant confirm that the component identified as "Structural Steel: beams, columns, plates and trusses" in various tables in LRA Section 2.4 includes the connection components (gusset plates, welds, bolts, etc.).

In its response to RAI 2.4.XX-1, dated July 24, 2008, the applicant confirmed that its Structural Monitoring Program requires inspection of all aspects of structural framing load path and the connection components (e.g., gusset plates, welds, bolts, girder and seat stiffeners) for license renewal SSCs are within the scope of license renewal and subject to an AMR.

On the basis of its review, the staff finds the applicant's response to RAI 2.4.XX-1 acceptable because the applicant has confirmed that all connection components are within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.4.XX-1 is resolved.

In RAI 2.4-1, dated June 4, 2008, the staff requested that the applicant confirm the consistency between the in-scope structures identified in LRA Section 2.4 and the LRA drawing "LR-STRUCTURES."

In its response to RAI 2.4-1, dated July 24, 2008, the applicant revised LRA drawing "LR-STRUCTURES" to label the in-scope structures consistent with those structures identified in LRA Section 2.4.

On the basis of its review, the staff finds the applicant's response to RAI 2.4-1 acceptable because the applicant has revised LRA drawing "LR-STRUCTURES" to conform to LRA Section 2.4. Therefore, the staff's concern described in RAI 2.4-1 is resolved.

The staff noted in LRA Table 2.4-1 that the applicant selected "EN" (enclosure or protection) for the metal siding. However, the applicant did not include "EN" as an intended function for the exterior wall and roof decking.

In RAI 2.4.1-1, dated June 4, 2008, the staff requested that the applicant clarify the intended function for the exterior walls above grade and the roof decking.

In its response to RAI 2.4.1-1, dated July 24, 2008, the applicant confirmed that for the alternate intake structure metal siding, the intended function “EN” was erroneously selected in LRA Table 2.4-1. The applicant stated that the definition of the intended function “EN” is shelter or protection of safety-related equipment and there is no safety-related equipment located in the alternate intake structure. The applicant revised LRA Table 2.4-1 to delete “EN” from the list of intended functions for the metal siding.

Based on its review, the staff finds the applicant’s response to RAI 2.4.1-1 acceptable, because the applicant has acknowledged that it erroneously selected “EN” as an intended function and as a result, revised LRA Table 2.4-1 to delete “EN” from the list of intended functions for metal siding. Therefore, the staff’s concern described in RAI 2.4.1-1 is resolved.

2.4.1.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff’s review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the alternate intake structure (common) 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

In LRA Section 2.4.2, the applicant described the auxiliary buildings. The Unit 1 auxiliary building is a safety-related, seismic Category I structure approximately 120 by 104 by 69 feet high, consisting of a basement and three upper stories located adjacent to and south of the Unit 1 service building. It houses various safety- and nonsafety-related primary systems.

A reinforced concrete foundation mat supports the auxiliary building and the uppermost floor supports a seismically-designed steel superstructure. Design of the reinforced concrete floors and walls below and for certain components above this elevation is for tornado protection for safety-related equipment and piping and for biological shielding, where required. The uppermost, heavily reinforced concrete slabs can accommodate a collapse of the steel framed structure above them without detriment to the integrity of the Class I portions below. This structure also includes the Category I pipe trench beneath its lower level to the RCB and the pipe trench beneath it to the fuel building.

The auxiliary building basement portion housing safety-related equipment is protected against flooding to El. 730’-0” (*i.e.*, PMF elevation). The charging pumps, located below the PMF and within watertight cubicles with water stops at construction joints below the PMF elevation, are the only equipment required to maintain plant shutdown during the PMF. The remainder of the basement is allowed to flood to eliminate hydraulic uplift. The pipe trenches from the auxiliary building to the containment and the fuel building also are allowed to flood.

Steel framing above the uppermost floor slab supports the auxiliary building roof, which consists of a built-up membrane on steel decking. Exterior walls are concrete or protected, insulated metal fluted siding, designed to blow off under tornado loading to reduce wind loads on the superstructure. Some of the interior walls are concrete block.

The Unit 2 auxiliary building is a safety-related, seismic Category I structure approximately 120 by 145 by 63 feet high, consisting of a basement and three upper stories supported on a reinforced concrete foundation mat. The roof and walls of the top story are predominantly steel-framed with metal siding and metal roof decking, except for the ventilation core area, component cooling surge tank cubicle, and the air-conditioning room. These locations are reinforced concrete as is the remainder of the structure. Concrete walls and floors protect safety-related equipment and piping from tornados and provide biological shielding where required. The top story steel framing design is not for tornado protection.

The concrete exterior walls and foundation mat protect against external flood up to El. 730'-0". Construction joints in the exterior walls and mats below El. 730'-0" have water stops. Above El. 773'-6", the concrete ventilation core area, component cooling surge tank cubicle, and air conditioning room are tornado-protected, although the seismic Category I steel frame top story structure is not tornado protected. The metal siding around the top story is designed to blow off under tornado loading to reduce wind loads on the superstructure.

The auxiliary building contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the auxiliary building potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the auxiliary building performs functions that support fire protection and SBO.

LRA Table 2.4-2 identifies auxiliary building component types within the scope of license renewal and subject to an AMR.

2.4.2.2 Staff Evaluation

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

During its review of LRA 2.4.2, the staff evaluated the structural component functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.2.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the auxiliary building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.3 Boric Acid Tank Building (Unit 1 Only)

2.4.3.1 Summary of Technical Information in the Application

In LRA Section 2.4.3, the applicant described the boric acid tank building (Unit 1 only), a nonsafety-related, seismic Category II structure located adjacent to the southeast corner of the auxiliary building and housing the boric acid hold tank and its equipment, none of which is within the scope of license renewal. At approximately 20 feet by 23 feet by 43 feet high, the boric acid tank building consists of a reinforced concrete structure and foundation mat, a concrete roof deck supported by a steel beam, and no interior walls or floors. The building, as designed, will not collapse onto nearby structures.

The failure of nonsafety-related SSCs in the boric acid tank building (Unit 1 only) potentially could prevent the satisfactory accomplishment of a safety-related function.

LRA Table 2.4-3 identifies boric acid tank building (Unit 1 only) component types within the scope of license renewal and subject to an AMR.

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 identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the boric acid tank building. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to LRA Section 2.4.3, the corresponding applicant responses, and the staff evaluation.

In LRA Section 2.4.3, the applicant identified the intended function of Unit 1 Boric Acid Tank Building as support for compliance with 10 CFR 54.4(a)(2). Based on UFSAR Table 9.2-2 for Unit 1, the boric acid hold tank is protected from tornado by concrete walls.

In RAI 2.4.3-1, dated June 4, 2008, the staff requested that the applicant clarify the intended function of the boric acid tank building exterior walls and roof slab relative to tornado protection.

In its response to RAI 2.4.3-1, dated July 24, 2008, the applicant confirmed that although the boric acid tank building was designed not to collapse due to tornado wind pressure loading and earthquake, the exterior walls and the roof of this building were not designed as barriers for tornado generated missiles. Therefore, the 10 CFR 54.4(a)(2) intended function currently identified in LRA Section 2.4.3 is accurate and sufficient.

Based on its review, the staff finds the applicant's response to RAI 2.4.3-1 acceptable because the applicant has confirmed that the design of the Unit 1 exterior walls and the roof is for tornado wind pressure only and that the boric acid tank building is classified as a nonsafety-related seismic category II structure designed not to collapse due to tornado wind load and earthquake. Therefore, the staff's concern described in RAI 2.4.3-1 is resolved.

2.4.3.3 Conclusion

The staff reviewed the LRA and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal.
The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the boric acid tank building (Unit 1 only) 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 Cable Tunnel

2.4.4.1 Summary of Technical Information in the Application

In LRA Section 2.4.4, the applicant described the cable tunnels. The Unit 1 cable tunnel is a safety-related, seismic Category I reinforced concrete subsurface structure housing safety-related electrical equipment. The cable tunnel is the service building area for transfer of cable from the cable vault structure to the building's cable tray area and is situated northeast of the cable vault. One part of the cable tunnel runs vertically from El. 725'-6" to El. 754'-6" and another runs horizontally from the cable vault area northward into the service building. The vertical and horizontal parts divide into two compartments by a north-south concrete wall. There are no equipment or floor drains in the cable tunnel but water stops are placed within construction joints all around the cable tunnel.

The Unit 2 cable tunnel is a safety-related, seismic Category I subsurface structure of reinforced concrete foundation mat, walls, and roof extending approximately 82 feet from the auxiliary building to the control building. The concrete structure of the cable tunnel protects safety-related electrical systems from tornados. The bottom of the cable tunnel's foundation is at El. 709'-6" and is designed for external flood protection up to El. 730'.

The cable tunnel contains safety-related components relied upon to remain functional during and following DBEs. In addition, the cable tunnel performs functions that support fire protection.

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

2.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.4.4 and UFSAR 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 2.4.4, the staff evaluated the structural component functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.4.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal.
The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the cable tunnel 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 Chemical Addition Building (Unit 1 Only)

In LRA Section 2.4.5, the applicant described the chemical addition building (Unit 1 only), a safety-related, seismic Category I structure approximately 19 by 31 by 11 feet high and located adjacent to the refueling water storage tank. Supported on a reinforced concrete foundation mat, this building has metal siding and a metal roof deck and houses the caustic tank pumps of the containment depressurization system. The top of the foundation for the chemical addition building is at El. 735'-0", the site grade elevation. The roof, supported by steel framing, consists of a built-up membrane on steel decking.

The chemical addition building (Unit 1 only) contains safety-related components relied upon to remain functional during and following DBEs.

LRA Table 2.4-5 identifies chemical addition building (Unit 1 only) component types within the scope of license renewal and subject to an AMR.

2.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.4.5 and UFSAR 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 2.4.5, the staff evaluated the structural component functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.5.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the chemical addition building (Unit 1) 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 Condensate Polishing Building (Unit 2 Only)

2.4.6.1 Summary of Technical Information in the Application

In LRA Section 2.4.6, the applicant described the condensate polishing building (Unit 2 only), a nonsafety-related, seismic Category II (designed not to collapse in a safe-shutdown earthquake) structure with no safety-related equipment. Located adjacent to and west of the waste handling building and consisting of a basement and three upper stories, the L-shaped condensate polishing building has a main portion of approximately 44 by 141 feet and a maximum height of 93 feet.

The foundation mat supporting the structure and the roof, walls, and floor slabs are reinforced concrete. The steel framing, supporting the metal decking beneath the reinforced concrete roof slab, is designed such that it is not a secondary missile under earthquake, tornado, or probable maximum precipitation conditions.

The failure of nonsafety-related SSCs in the condensate polishing building (Unit 2 only) could potentially prevent the satisfactory accomplishment of a safety-related function. The condensate polishing building (Unit 2 only) also performs functions that support fire protection.

2.4.6.2 Staff Evaluation

The staff reviewed LRA Section 2.4.6 and UFSAR 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 2.4.6, the staff evaluated the structural component functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.6.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the condensate polishing building (Unit 2 only) 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 Control Building (Unit 2 Only)

2.4.7.1 Summary of Technical Information in the Application

In LRA Section 2.4.7, the applicant described the control building (Unit 2 only), a safety-related, seismic Category I structure consisting of three stories adjacent to the Unit 1 service building. The top story contains the Unit 2 portion of the MCR, the computer room, and the heating, ventilation, and air-conditioning equipment room. The lower two stories house switchgear, cable spreading areas, and other equipment. As noted in LRA Section 2.4.26, the MCR is common to Unit 1 and 2 but split between the Unit 2 control building and the Unit 1 service building.

The Unit 2 Control Building, approximately 69 by 89 by 45 feet high, has a foundation mat, roof, and walls constructed of reinforced concrete designed for tornado protection. The exterior and some interior concrete walls have missile barrier functions, while the main entrance incorporates light structural steel framing, siding, and roof decking. Construction joints in the exterior walls and mats below El. 730'-0" have water stops.

Positive pressure in the control room envelope minimizes, during emergency operation, in-leakage through doors, ducts, pipes, and cable penetrations from wind effects and pressure variations. Special construction features, including compression seals for access doors and equipment removal hatches, penetration seals for pipes, ducts, and electrical penetrations, and water trap seals for sanitary piping, maintain the leak-tightness of the common control room boundary. Shielding by the MCR walls and the separation of the MCR from the containment structure, ensure operator ability to remain in the MCR for 30 days after an accident and not receive an integrated radiation dose in excess of 5 rem.

The control building (Unit 2 only) contains safety-related components relied upon to remain functional during and following DBEs. In addition, the control building (Unit 2 only) performs functions that support fire protection and SBO.

2.4.7.2 Staff Evaluation

The staff reviewed LRA Section 2.4.7 and UFSAR 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 2.4.7, the staff evaluated the structural component functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.7.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff’s review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the control building (Unit 2 only) 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 Decontamination Building

2.4.8.1 Summary of Technical Information in the Application

In LRA Section 2.4.8, the applicant described the decontamination buildings. The Unit 1 decontamination building is a nonsafety-related, seismic Category II steel frame and siding building abutting the west end of the fuel building's south wall. The building is used to decontaminate plant equipment.

The structure houses no safety-related equipment and by design, its steel framing will not collapse and endanger systems or structures requiring protection.

In the 77-foot tall single-story building, equipment can be decontaminated without uncontrolled release of activity into the environment. A 125-ton trolley runs through the high-bay portion of the decontamination building into the west end of the fuel building to the north and on a high-level runway out over the road to the south. Stainless steel walls, eight feet high, separate the central area and stainless steel covers the floor to form an area for washing down fuel casks and other equipment. A stainless steel pad protects the floor under heavy objects.

The Unit 2 decontamination building is a safety-related, seismic Category I structure housing equipment for washing fuel casks. Although classified as safety-related, the building houses no safety-related equipment. The decontamination building is integral to the fuel building. UFSAR Section 3.8.4.1.4 for Unit 2 describes the two buildings as one structure, but for license renewal purposes, their evaluations are separate. Situated north of the fuel building's east end, the decontamination building is approximately 33 by 33 feet. A concrete wall and a set of doors separate the two buildings, and a continuous reinforced concrete foundation mat supports the decontamination building.

The building's roof and walls are concrete with external flood protection and water stops are provided at all construction joints up to El. 730'-0" (the PMF elevation). The decontamination building is also a tornado-protected structure. Steel framing supports the metal decking beneath the reinforced concrete roof slab. The steel framing is designed such that it is not a secondary missile under earthquake, tornado, or probable maximum precipitation conditions. A 125-ton trolley runs from the fuel building to the decontamination area (building) to the yard area. The top of the crane girder is at El. 797'-10".

LRA Table 2.4-8 identifies decontamination building component types within the scope of license renewal and subject to an AMR.

2.4.8.2 Staff Evaluation

The staff reviewed LRA Section 2.4.8 and UFSAR 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 2.4.8, the staff identified areas in which additional information was necessary to complete its evaluation of the applicant's scoping and screening results for the decontamination buildings. Therefore, the staff issued RAIs to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1).

The following discussion describes the staff's RAIs related to LRA Section 2.4.8, the corresponding applicant responses, and the staff evaluation.

Based on the applicant's description of the decontamination building in LRA Section 2.4.8 and UFSAR Table 3.2-2 for Unit 2, the staff issued RAI 2.4.8-1, dated June 4, 2008, requesting that the applicant clarify the intended function of this building relative to flood barrier.

In its response to RAI 2.4.8-1, dated July 24, 2008, the applicant confirmed that (1) all exterior walls are located above the flood elevation; (2) there are no safety-related SSC in the decontamination building that would require flood protection; (3) there is an interior sump in the foundation base mat with the bottom elevation of 18 inches above the flood elevation; and (4) the top of the foundation base mat is 5'-6" above flood elevation. Therefore, the applicant stated that the intended function of flood barrier was not assigned to any of the in-scope components identified in LRA Table 2.4-8.

Based on its review, the staff finds the applicant's response to RAI 2.4.8-1 acceptable because the applicant has properly clarified the intended function of the decontamination building relative to flood barrier. Therefore, the staff's concern described in RAI 2.4.8-1 is resolved.

In LRA Section 2.4.8, the applicant indicated in its description of the decontamination building that the stainless steel lined floor and walls are provided for equipment wash-down. The staff noted that LRA Table 2.4-8 did not include stainless steel liner nor did LRA Table 3.5.2-8 identify the stainless steel liner material subject to an AMR.

In RAI 2.4.8-2, dated June 4, 2008, the staff requested that the applicant confirm that the stainless steel liner is within the scope of license renewal and subject to an AMR or provide justification for the exclusion.

In its response to RAI 2.4.8-2, dated July 24, 2008, the applicant confirmed that the intent of the stainless steel liner is to provide a suitable surface for decontamination purposes only and it does not perform any intended functions pursuant to 10 CFR 54.4 (a)(1), (a)(2), or (a)(3) and as a result, was excluded from the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.4.8-2 acceptable because the applicant has provided adequate justification for excluding the stainless steel liner from the scope of license renewal pursuant to 10 CFR 54.4 (a)(1), (a)(2), or (a)(3). Therefore, the staff's concern described in RAI 2.4.8-2 is resolved.

2.4.8.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the decontamination 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).

2.4.9 Diesel Generator Building

2.4.9.1 Summary of Technical Information in the Application

In LRA Section 2.4.9, the applicant described the diesel generator buildings. The Unit 1 diesel generator building is a safety-related, seismic Category I structure located adjacent to and south of the Unit 1 fuel building. The diesel generator building is a single-story, reinforced concrete structure approximately 57 by 61 by 32 feet high (including two penthouses, one each for gas and air exhaust) supported on a reinforced concrete foundation mat.

The building houses the EDGs. Its walls and roof are constructed of reinforced concrete and designed to provide tornado protection. A pipe trench, which passes under the 12- inch thick wall between the two diesel generator compartments, has fuel oil cross connections that run between the two diesel fuel oil pump suction and discharge pipelines.

The diesel generator building is above the PMF elevation. The two fuel oil storage tanks for the diesel generators and the fuel oil piping outside the diesel generator building are buried and covered with a two feet thick concrete slab for missile protection. In addition, a concrete partition separates the lines from each tank from one another.

The Unit 2 diesel generator building is a safety-related, seismic Category I structure housing the EDGs. The two-story building is approximately 78 by 88 by 57 feet high and is supported on a reinforced concrete foundation mat above the PMF elevation. Reinforced concrete roof and walls protect the building from tornados and missiles. Underground concrete, enveloping the EDG fuel oil tanks below the diesel generator building, is part of the building structure.

The diesel generator building has two separate areas, each housing one EDG and its auxiliary systems and electrical and/or control equipment. The concrete wall separating the two areas is designed to withstand a safe-shutdown earthquake, fire, or missiles. Each of the redundant fuel oil systems is in a separate room within the diesel generator building.

The south exterior wall of the building adjacent to the system station service transformer has a three-hour fire rating as has the exterior door to the diesel generator in this area. Material that seals penetrations of exterior and interior walls that form the fire barriers has a rating equivalent to the barrier rating, except for the intake and exhaust openings that are separated by sufficient distance to preclude fire propagation.

The diesel generator building contains safety-related components relied upon to remain functional during and following DBEs. In addition, the diesel generator building performs functions that support fire protection and SBO.

LRA Table 2.4-9 identifies diesel generator building component types within the scope of license renewal and subject to an AMR.

2.4.9.2 Staff Evaluation

The staff reviewed LRA Section 2.4.9 and UFSAR 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 2.4.9, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the diesel generator buildings. Therefore, the staff issued RAIs to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAIs related to LRA Section 2.4.9, the corresponding applicant responses, and the staff evaluation.

Based on the applicant's description of the diesel generator building in LRA Section 2.4.9 and UFSAR Section 8.5.2.4 for Unit 1, the staff issued RAI 2.4.9-1, dated June 4, 2008, requesting that the applicant clarify the intended function of the interior walls relative to missile barrier.

In its response to RAI 2.4.9-1, dated July 24, 2008, the applicant confirmed that the interior wall, separating the Unit 1 diesel generator sets, performs a missile barrier function by protecting each set of diesel generators from internally generated missiles. The applicant revised LRA Section 2.4, Tables 2.4-9 and 3.5.2-9 to correct this oversight.

Based on its review, the staff finds the applicant's response to RAI 2.4.9-1 acceptable because the applicant adequately clarified the intended function of the interior walls relative to missile barrier and revised LRA Section 2.4, Tables 2.4-9 and 3.5.2-9 to include missile barrier intended function for the interior walls. Therefore, the staff's concern described in RAI 2.4.9-1 is resolved.

The applicant discussed the diesel generator building in UFSAR Section 3.8.4.1.6 for Unit 2. The UFSAR references included in LRA Section 2.4.9 do not include UFSAR Section 3.8.4.1.6. Therefore, the staff issued RAI 2.4.9-2, dated June 4, 2008, requesting that the applicant clarify LRA Section 2.4.9.

In its response to RAI 2.4.9-2, dated July 24, 2008, the applicant revised LRA Section 2.4.9 to include as a reference, UFSAR Section 3.8.4.1.6 for Unit 2.

Based on its review, the staff finds the applicant's response to RAI 2.4.9-2 acceptable because the applicant has revised LRA Section 2.4.9 to add a reference to UFSAR Section 3.8.4.1.6 for Unit 2. Therefore, the staff's concern described in RAI 2.4.9-2 is resolved.

2.4.9.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the diesel generator building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.10 Emergency Outfall Structure (Unit 2 Only)

2.4.10.1 Summary of Technical Information in the Application

In LRA Section 2.4.10, the applicant describes the safety-related, seismic Category I emergency outfall structure (Unit 2), a dual-chambered overflow weir approximately 21 by 35 by 24 feet high and situated about 1,900 feet west of the center of the RCB for Unit 2. It protects the ends of the service water lines from missile impact and maintains proper hydraulic head within the SWS. If normal service water flow via the circulating water system to the cooling tower is blocked, service water discharge is re-routed to the emergency outfall structure and on to the Ohio River.

The emergency outfall structure is constructed of reinforced concrete. The bottom of the emergency outfall structure is at El. 710'-0" and the top at approximately El. 737'-5" and is designed to remain functional under postulated tornado and tornado-generated missile loadings.

The emergency outfall structure (Unit 2 only) contains safety-related components relied upon to remain functional during and following DBEs. In addition, the emergency outfall structure (Unit 2 only) performs functions that support SBO.

LRA Table 2.4-10 identifies emergency outfall structure (Unit 2 only) component types within the scope of license renewal and subject to an AMR.

2.4.10.2 Staff Evaluation

The staff reviewed LRA Section 2.4.10 and UFSAR 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 2.4.10, the staff evaluated the structural component functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.10.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the emergency outfall structure (Unit 2 only) 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 Emergency Response Facility Diesel Generator Building (Common)

2.4.11.1 Summary of Technical Information in the Application

In LRA Section 2.4.11, the applicant described its emergency response facility (ERF) diesel generator building (common), also known as the reserve generator building. The ERF diesel generator building is a nonsafety-related, nonseismic structure approximately 41 by 23 by 16 feet high and is located south of the plant and north of the ERF substation building. The ERF diesel generator building houses the nonsafety-related ERF diesel generator (also known as the reserve generator or the black diesel) that powers via the ERF substation switchgear the Unit 1 dedicated AFW pump, the Unit 1 ATWS mitigation system actuation circuitry panel and Unit 2 diesel-driven station air compressor equipment. The applicant's evaluation of the ERF diesel generator building included nearby concrete foundations for the ERF diesel generator cooler (water-to-air heat exchanger) and cooler fans.

The building is a pre-engineered, steel-framed, single-story structure with insulated metal siding, a metal roof, and a concrete mat foundation. The top of the foundation slab is at El. 735'-6". A 30,000-gallon fuel oil storage tank buried near the ERF diesel generator building can supply the ERF diesel for seven days. The bottom of the tank, at approximately El. 732'-6" (*i.e.*, above the PMF elevation of El. 730'-0"), rests on undisturbed soil. A concrete roof slab and concrete walls partially cover the tank and form a vault for its piping and equipment. Pea gravel fills the space between the sheet piling and the tank and vault.

The ERF diesel generator building (common) performs functions that support fire protection. LRA Table 2.4-11 identifies ERF diesel generator building (common) component types within the scope of license renewal and subject to an AMR.

2.4.11.2 Staff Evaluation

The staff reviewed LRA Section 2.4.11 and UFSAR 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 2.4.11, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the ERF diesel generator building. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to LRA Section 2.4.11, the corresponding applicant responses, and the staff evaluation.

In LRA Section 2.4.11, the applicant stated that pea gravel was used to fill the space between the sheet piling, the tank and vault.

In RAI 2.4.11-1, dated June 4, 2008, the staff requested that the applicant provide justification for excluding the sheet piling from the scope of license renewal.

In its response to RAI 2.4.11-1, dated July 24, 2008, the applicant confirmed that the sheet piling was installed for excavation purposes during the original building construction. The applicant stated that since the sheet piling serves no structural purpose or license renewal intended function subsequent to construction of the original building, it was excluded from the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.4.11-1 acceptable because the applicant has confirmed that the sheet piling was installed as a construction aid and serves no intended function for license renewal. Therefore, the staff's concern described in RAI 2.4.11-1 is resolved.

2.4.11.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the ERF diesel generator building (common) 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 Emergency Response Facility Substation Building (Common)

2.4.12.1 Summary of Technical Information in the Application

In LRA Section 2.4.12, the applicant described the ERF substation building (common), a nonsafety-related, nonseismic structure approximately 60 by 30 by 32 feet high and located south of the plant. The ERF substation building houses two 4kV buses and 480 VAC, 120 VAC, and 125 VDC equipment, all of which is necessary to supply components in Units 1 and 2.

The building consists of two stories, the first floor at El. 735'-6" and the second at El. 751'-6". Grade on the north and west sides of the building is at El. 735'-0" and varies between El. 735'-0" and El. 744'-0" on the south and east sides. A concrete retaining wall and sheet piling are on the west side of the building at its south end and the building's foundation is concrete. The ERF substation building (common) primarily is a steel-framed structure with metal siding, with some exterior walls constructed of concrete with metal siding. The roof consists of insulated metal decking with a built-up membrane.

The ERF substation building (common) provides structural or functional support for fire protection and ATWS.

LRA Table 2.4-12 identifies ERF substation building (common) component types within the scope of license renewal and subject to an AMR.

2.4.12.2 Staff Evaluation

The staff reviewed LRA Section 2.4.12 and UFSAR 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 2.4.12, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the ERF substation building. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to LRA Section 2.4.12, the corresponding applicant responses, and the staff evaluation.

In LRA Section 2.4.12, the applicant stated that a concrete retaining wall and sheet piling are located on the west side of the building. LRA Table 2.4-12 does not include the concrete retaining wall and the sheet piling.

In RAI 2.4.12-1, dated June 4, 2008, the staff requested that the applicant provide justification for excluding these components from the scope of license renewal.

In its response to RAI 2.4.12-1, dated July 24, 2008, the applicant confirmed that neither the concrete retaining wall nor the sheet piling is part of the ERF substation building foundation system. The applicant stated that the retaining wall has a nominal connection with the ERF substation building. In a follow-up letter dated August 22, 2008, the applicant further confirmed that a potential adverse interaction between the retaining wall and the ERF substation building is not identified in the BVPS CLB and the plant or industry experience does not indicate such interaction could exist. Therefore, the applicant stated that the nonsafety-related retaining wall and the sheet piling do not provide license renewal intended functions and have been excluded from the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.4.12-1 acceptable because the applicant has confirmed that the nonsafety-related retaining wall and sheet piling are not part of the building's foundation and that interaction between the retaining wall and the building is not part of the BVPS CLB. Therefore, the staff's concern described in RAI 2.4.12-1 is resolved.

2.4.12.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the ERF substation 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).

2.4.13 Equipment Hatch Platform

2.4.13.1 Summary of Technical Information in the Application

In LRA Section 2.4.13, the applicant described the equipment hatch platforms. The Unit 1 equipment hatch platform is a safety-related, seismic Category I structure adjacent to and southwest of the containment. At approximately 27 feet by 27 feet by 46 feet high, the platform protects the equipment hatch. Supported on a reinforced concrete foundation mat, the platform has reinforced concrete walls and slabs designed to protect the containment equipment hatch from tornado-generated missile. The platform has a removable missile shield enclosure consisting of various wall assemblies and roof sections. The bottom of the equipment hatch platform foundation is at El. 732'-0", which is above the PMF elevation of El. 730 feet.

The Unit 2 equipment hatch platform is a safety-related, seismic Category I structure adjacent and northeast of the RCB. At approximately 29 feet by 31 feet by 49 feet high, the platform protects the equipment hatch.

Supported on a reinforced concrete foundation mat, the platform walls and slabs are reinforced concrete designed to protect the containment equipment hatch from tornado-generated missiles. The walls and slabs are removable. The equipment hatch platform is protected from external flooding up to El. 730 feet.

The equipment hatch platform contains safety-related components relied upon to remain functional during and following DBEs.

LRA Table 2.4-13 identifies equipment hatch platform component types within the scope of license renewal and subject to an AMR.

2.4.13.2 Staff Evaluation

The staff reviewed LRA Section 2.4.13 and UFSAR 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 2.4.13, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the equipment hatch platforms. Therefore, the staff issued RAIs to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAIs related to LRA Section 2.4.13, the corresponding applicant responses, and the staff evaluation.

In UFSAR Section 3.8.4.1.12 for Unit 2, the applicant discussed equipment hatch platform. However, the UFSAR references included in LRA Section 2.4.13 did not include UFSAR Section 3.8.4.1.12. In RAI 2.4.13-1, dated June 4, 2008, the staff requested that the applicant clarify LRA Section 2.4.13.

In its response to RAI 2.4.13-1, dated July 24, 2008, the applicant revised LRA Section 2.4.13 to include as a reference, UFSAR Section 3.8.4.1.12 for Unit 2.

Based on its review, the staff finds the applicant's response to RAI 2.4.13-1 acceptable because the applicant revised LRA Section 2.4.13 to include a reference to UFSAR Section 3.8.4.1.12 for Unit 2. Therefore, the staff's concern described in RAI 2.4.13-1 is resolved.

The staff noted in LRA Section 2.4.13, that both Units 1 and 2 equipment hatch platforms have reinforced concrete walls and slabs. In LRA Table 2.4-13 for Unit 1 equipment hatch platform, the applicant identified floor slabs as an in-scope component.

In RAI 2.4.13-2, dated June 4, 2008, the staff requested that the applicant clarify the scoping difference between the Units 1 and 2 equipment hatch platforms.

In its response to RAI 2.4.13-2, dated July 24, 2008, the applicant confirmed that due to design differences in the Units 1 and 2 equipment hatch platforms, the in-scope components identified in LRA Table 2.4-13 are different. The applicant stated that the listed in-scope components are consistent with the equipment hatch platform structural configuration and are subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.4.13-2 acceptable because the applicant confirmed that (1) design differences between the Unit 1 and 2 equipment hatch platforms produce different in-scope components, (2) there are no omissions in LRA Table 2.4.13, and (3) the identified components are consistent with the structural configuration of Unit 1 and 2 equipment hatch platforms. Therefore, the staff's concern described in RAI 2.4.13-2 is resolved.

2.4.13.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the equipment hatch platform 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 Fuel Building

2.4.14.1 Summary of Technical Information in the Application

In LRA Section 2.4.14, the applicant described the fuel buildings. The Unit 1 fuel building is a safety-related, seismic Category I structure approximately 41 by 107 by 60 feet high and is located adjacent to and south of the Unit 1 auxiliary building. The fuel building houses the new and spent fuel and fuel handling facilities, including the reinforced concrete fuel pool, and is supported on a continuous reinforced concrete foundation mat. The fuel building superstructure steel framing is designed not to collapse and endanger SSCs required for safe-shutdown. The metal siding, cladding the superstructure, is designed to blow off under tornado loading to reduce wind loads on the superstructure. The fuel building elevation is higher than the PMF elevation.

The fuel building houses racks for both new and used fuel. New fuel assemblies are stored dry in a steel and concrete structure within the fuel building. The new fuel storage racks are stainless steel fuel guide assemblies bolted into stainless steel support structures. In a separate pool area, spent fuel is stored underwater in stainless steel racks. Neutron-absorbing material (Boral®) installed in spent fuel racks assure spent fuel subcriticality. The sides of the spent fuel pool are constructed of concrete six feet thick. The pool is filled with borated water and fully lined with stainless steel to prevent leakage.

The Unit 2 fuel building is a safety-related, seismic Category I structure approximately 44 by 110 feet housing the new and spent fuel and fuel handling facilities, including the reinforced concrete fuel pool. The building has roof and walls of reinforced concrete supported on a continuous reinforced concrete foundation mat.

Safety-related equipment and the spent fuel have protection against tornadoes and tornado-generated missiles. Steel framing supporting the metal decking under the reinforced concrete roof slab is designed not to be a secondary missile under earthquake, tornado, or probable maximum precipitation conditions. There is external flood protection up to El. 730'-0".
New fuel assembly is stored dry in a steel and concrete structure within the fuel building. The new fuel storage racks are stainless steel fuel guide assemblies bolted into stainless steel support structures. The spent fuel storage racks, housed within the spent fuel pool, are of stainless steel with Boraflex (boron carbide in nonmetallic binders), a neutron-absorbing material. The spent fuel rack criticality analysis takes no credit for any of this neutron-absorbing material but credits soluble boron to maintain spent fuel subcriticality. The concrete sides of the spent fuel pool, three of which also form parts of the fuel building exterior walls, are six feet thick. The pool is lined with stainless steel and filled with borated demineralized water.

The fuel building contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the fuel building potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the fuel building performs functions that support fire protection.

LRA Table 2.4-14 identifies fuel building component types within the scope of license renewal and subject to an AMR.

2.4.14.2 Staff Evaluation

The staff reviewed LRA Section 2.4.14 and UFSAR 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 2.4.14, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the fuel buildings. Therefore, the staff issued RAIs to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAIs related to LRA Section 2.4.14, the corresponding applicant responses, and the staff evaluation.

In RAI 2.4.14-1, dated June 4, 2008, the staff requested that the applicant confirm that the leak chase system for the spent fuel pool liner has been screened-in as components subject to an AMR or provide justification for the exclusion.

In its response to RAI 2.4.14-1, dated July 24, 2008, the applicant confirmed that the leak chase system for the spent fuel pool liner is within the scope of license renewal, included in LRA Table 2.4-14 as "spent fuel pool liner," and subject to an AMR. Also, the piping associated with the spent fuel pool leak chase system is considered within the scope of license renewal and evaluated as a mechanical component in LRA Section 2.3.3.

Based on its review, the staff finds the applicant's response to RAI 2.4.14-1 acceptable because the applicant confirmed that the leak chase system for the spent fuel pool liner is within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.4.14-1 is resolved.

In RAI 2.4.14-2, dated June 4, 2008, the staff requested that the applicant confirm that the Unit 2 spent fuel rack neutron absorbers are within the scope of license renewal and subject to an AMR, or provide justification for the exclusion.

In its response to RAI 2.4.14-2, dated July 24, 2008, the applicant confirmed that the Unit 2 spent fuel rack criticality analysis only credits the soluble boron and that the Boraflex® neutron absorber is not credited to maintain subcriticality of stored fuel. The Boraflex® neutron absorber has been excluded from the scope of license renewal since it performs no license renewal intended function.

Based on its review, the staff finds the applicant's response to RAI 2.4.14-2 acceptable because the applicant has confirmed that Boraflex® neutron absorber is not credited to maintain subcriticality of stored fuel and it performs no license renewal intended function. Therefore, the staff's concern described in RAI 2.4.14-2 is resolved.

In LRA Table 2.4-14, the staff noted that the applicant did not identify floor slabs as an in-scope component. In RAI 2.4.14-3, dated June 4, 2008, the staff requested that the applicant confirm that floor slabs are within the scope of license renewal and subject to an AMR, or provide justification for excluding them from the scope of license renewal.

In its response to RAI 2.4.14-3, dated July 24, 2008, the applicant confirmed that the floor slabs of both Units 1 and 2 are within the scope of license renewal and subject to an AMR, and revised LRA Tables 2.4-14 and 3.5.2-14 to include floor slabs.

Based on its review, the staff finds that the applicant's response to RAI 2.4.14-3 is acceptable because the applicant has confirmed that the Units 1 and 2 floor slabs are within the scope of license renewal and subject to an AMR. Further, the applicant revised LRA Tables 2.4-14 and 3.5.2-14 to include floor slabs. Therefore, the staff's concern described in RAI 2.4.14-3 is resolved.

2.4.14.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the fuel building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.15 Gaseous Waste Storage Vault

2.4.15.1 Summary of Technical Information in the Application

In LRA Section 2.4.15, the applicant described the gaseous waste storage vaults. The Unit 1 gaseous waste storage vault (also referred to in the UFSAR for Unit 1 as the waste gas storage area) is a safety-related, seismic Category I structure at approximately 37 by 23 by 43 feet and located directly east of the fuel building housing nonsafety-related gaseous waste decay tanks. The gaseous waste storage vault is a reinforced concrete structure, constructed mostly underground for tornado protection. There are no water sources that could cause flooding above or connected to the gaseous waste storage vault. The vault is structurally protected against ingress of water from the PMF.

The Unit 2 gaseous waste storage vault (Enclosure), a nonsafety-related, seismic Category II structure located north of the fuel building, is an in-ground, one-story structure 37 by 52 by 15 feet high with an at-grade entrance 11 by 18.25 by 10 feet high. The structure houses the nonsafety-related gaseous waste storage tanks and is supported on a reinforced concrete foundation mat with walls, roof, and interior structures also constructed of reinforced concrete. Steel framing, which supports the internal stairs, is designed not to be a secondary missile under earthquake, tornado, or probable maximum precipitation conditions.

The gaseous waste storage vault contains safety-related components relied upon to remain functional during and following DBEs Unit 1 only). The failure of nonsafety-related SSCs in the gaseous waste storage vault potentially could prevent the satisfactory accomplishment of a safety-related function (Unit 2 only). In addition, the gaseous waste storage vault performs functions that support fire protection (Unit 2 only).

LRA Table 2.4-15 identifies gaseous waste storage vault component types within the scope of license renewal and subject to an AMR.

2.4.15.2 Staff Evaluation

The staff reviewed LRA Section 2.4.15 and UFSAR 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 2.4.15, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the gaseous waste storage vault. Therefore, the staff issued an RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to LRA Section 2.4.15, the corresponding applicant responses, and the staff evaluation.

In UFSAR Section 3.8.4.1.18 for Unit 2, the applicant stated that the gaseous waste storage enclosure provides biological shielding where required.

In RAI 2.4.15-1, dated June 4, 2008, the staff requested that the applicant clarify the intended function of the Unit 2 gaseous waste storage vault (Enclosure) relative to biological shielding.

In its responses to RAI 2.4.15-1, dated July 24, 2008 and August 22, 2008, the applicant confirmed that no plant personnel are required to access the gaseous waste storage vault for plant safe-shutdown or accident mitigation actions; and, this structure is not credited with providing radiological shielding to plant personnel during or after an accident or for providing shielding in support of any 10 CFR 54.4(a)(1), (a)(2) or (a)(3) functions. Therefore, the applicant stated that radiological shielding is not an intended function for the gaseous waste storage vault.

Based on its review, the staff finds the applicant's response to RAI 2.4.15-1 acceptable because the applicant has adequately clarified the function of the Unit 2 gaseous waste storage vault and confirmed that radiological shielding is not an intended function. Therefore, the staff's concern described in RAI 2.4.15-1 is resolved.

2.4.15.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the gaseous waste storage vault SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.16 Guard House (Common)

2.4.16.1 Summary of Technical Information in the Application

In LRA Section 2.4.16, the applicant described the guard house (common), a nonsafety-related, nonseismic structure housing a diesel generator. A day tank within the diesel generator room supplies fuel for the diesel generator. The guard house was originally a single-story structure. Two stories and a penthouse were added onto the original structure and onto its west end. Foundations for the original guard house and additions are slabs on grade with perimeter footings. Steel framing supports the second floor and roof over the original guard house. Pre-cast concrete floor and roof panels support the second floor and roof of the addition.

The guard house provides structural or functional support for fire protection.

LRA Table 2.4-16 identifies guard house (common) component types within the scope of license renewal and subject to an AMR.

2.4.16.2 Staff Evaluation

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

During its review of LRA Section 2.4.16, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal, to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.16.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the guard house SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.17 Intake Structure (Common)

2.4.17.1 Summary of Technical Information in the Application

In LRA Section 2.4.17, the applicant described the intake structure, a safety-related, seismic Category I structure common to both Units 1 and 2 and approximately 85 by 112 by 122 feet high. The seismic Category I portion of the intake structure houses the Unit 1 river water pumps, the Unit 2 service water pumps, the motor-driven fire pump, and the engine-driven fire pump. The structure protects these pumps and related equipment from tornados and tornado-generated missiles as well as flooding. The reinforced concrete slabs in this structure can accommodate the collapse of the light steel-framed structures above them. The seismic Category I duct lines and manholes that protect the electrical supply to the river water and service water pumps are included as part of the intake structure.

The intake structure is founded on a reinforced concrete mat at El. 637'-0" placed on compacted select granular fill, overlying dense in-situ granular soil extending to bedrock. The intake structure is constructed of reinforced concrete to the operating floor at El. 705'-0". Above this elevation, a steel superstructure with steel siding encloses four contiguous missile-protected, reinforced concrete pump rooms or cubicles. The cubicles have a common concrete roof two feet thick at El. 730'-0"; the north end of the roof is open across its width for ventilation purposes. Its exhaust vents and covers have gaskets for flood protection. The pump cubicle roof also supports several chemical addition (*e.g.*, clamicide) tanks. Water stops in construction joints in the concrete exterior walls protect the pump rooms or cubicles from flooding. The roof, at an approximate elevation of 760 feet, is steel decking supported on the steel framing. An overhead bridge crane, the screenwell crane, services the traveling screen areas, the raw water pumps, the Unit 1 river water pumps, and the Unit 2 service water pumps.

The intake structure contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the intake structure potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the intake structure performs functions that support fire protection and SBO.

LRA Table 2.4-17 identifies intake structure component types within the scope of license renewal and subject to an AMR.

2.4.17.2 Staff Evaluation

The staff reviewed LRA Section 2.4.17 and UFSAR 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 2.4.17, the staff evaluated the structural component functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a).
The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.17.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the intake structure (common) SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.18 Main Steam and Cable Vault

2.4.18.1 Summary of Technical Information in the Application

In LRA Section 2.4.18, the applicant described the main steam and cable vaults. The Unit 1 main steam and cable vault is a safety-related, seismic Category I structure with the following seismic Category I areas: cable vault, main steam valve area, pump room below the main steam valve area (housing AFW and quench spray pumps), and the main steam valve area ventilation room. Situated directly north and east of the RCB, the structure has a pipe chase or tunnel at the west end of the cable vault area connecting with the TB.

The main steam and cable vault is a reinforced concrete structure. The bottom of the foundation is at El. 712'-0". Floor slabs at several elevations correspond to four floors, with some floor elevations slightly different within different areas. The pipe chase or tunnel is at El. 722'-6". The roof slab elevations vary, with the lower slabs at El. 762'-0" and 767'-10" and the upper slabs at El. 783'-8" and 791'-2". Exterior walls are of concrete construction; however, the main steam and cable vault shares the RCB wall. No additional wall separates the main steam and cable vault from the reactor containment. Some of the interior walls within the cable vault are of concrete block construction. Steel platforms and their framing comprise the main steam valve area enclosed by concrete walls above El. 751'-0" and extending to the underside of the upper roof slab at El. 788'-6". Removable roof slabs are above the main steam valve area.

The lowest elevation of the cable vault and main steam valve areas is subject to flooding because the pipe tunnel that connects to the TB floods during the PMF. The pump room below the main steam valve area and its ventilation rooms is higher than the PMF elevation and not subject to flooding. Equipment in the main steam and cable vault, needed to maintain plant shutdown during the PMF, is located above El. 730 feet. Water stops are placed at the main steam and cable vault below-grade construction joints and around the pipe tunnel. Manually-operated louvers in the main steam valve area are designed to open and relieve any pressure build-up caused by a HELB jeopardizing building integrity.

The Unit 2 main steam and cable vault is a safety-related, seismic Category I, multi-level structure approximately 94 (at its widest part) by 138 by 77 feet high. The bottom of the main steam and cable vault foundation is at El. 712'-6". The cable vault (and rod control area) houses safety-related valves and piping which penetrate the containment building and run between other safety-related areas. The main steam valve area has safety-related components required for steam and feedwater isolation. A reinforced concrete foundation mat supports the multilevel structure, the remainder of which is also reinforced concrete. Water stops are placed at construction joints up to El. 731 feet, above the PMF elevation. The structure protects safety-related systems, including the MSIVs, from tornados. One Section of the roof is steel-framed with metal roof decking. That Section is nonseismic Category I and not designed for seismic or tornado loads.

Safety-related valves and electrical and control equipment in the main steam and cable vault are above the highest internal flood elevation. High-energy lines are on El. 718'-6" of the cable vault (and rod control area). No significant internal flood levels would ensue from postulated high-energy breaks because the steam release to the main steam valve area increases the pressure and a major portion of the released mass vents through openings in the main steam valve area to reduce pressure. Vent panels are in the walls near the main steam valve area roof. The main steam and cable vault is a target for turbine missiles. Reinforced concrete walls, roofs, and floors are for missile protection. Reinforced concrete walls, labyrinths, or steel missile barriers protect ventilation or penetration openings in the various buildings housing essential shutdown equipment. There are shields for postulated missiles ejected through inlet air flex connections for two axial fans in the cable vault area.

The main steam and cable vault contains safety-related components relied upon to remain functional during and following DBEs. In addition, the main steam and cable vault performs functions that support fire protection and SBO.

LRA Table 2.4-18 identifies main steam and cable vault component types within the scope of license renewal and subject to an AMR.

2.4.18.2 Staff Evaluation

The staff reviewed LRA Section 2.4.18 and UFSAR 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 2.4.18, the staff evaluated the structural component functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.18.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff’s review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the main steam and cable vault SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.19 Pipe Tunnel

2.4.19.1 Summary of Technical Information in the Application

In LRA Section 2.4.19, the applicant described the pipe tunnels. The Unit 1 pipe tunnel is a safety-related, seismic Category I structure with safety-related piping between the RWST and the cable vault area, including the trench that runs approximately 60 feet southwest and then 38'-6" south to the west side of the safeguards building. The tunnel is approximately 20' by 12'-8" by about 9'-6" high. Water stops are placed at construction joints all around the tunnel and a shake space separates the tunnel from adjacent structures. All essential piping from the RWST goes through missile-protected pipe trenches before entering the safeguards building by way of the cable vault structure or directly by way of the trench.

There are three Unit 2 pipe tunnels that are within the scope of license renewal. Two are safety-related, seismic Category I structures while the third is a nonsafety-related structure. One safety-related tunnel connects the service building, main steam and cable vault, and safeguards building and is approximately 10 feet wide by 42 feet long by 13 feet deep. The second safety-related tunnel, connecting the auxiliary building with the fuel building, is 7 feet wide by 6 feet deep with one portion 14 feet wide by 8 feet deep. The reinforced concrete safety-related pipe tunnels are protected against external flooding up to El. 730 feet. These safety-related tunnels provide protection against tornados except for approximately 103 feet of length adjacent to the fuel and decontamination buildings. This unprotected length of tunnel has no safety-related piping, components, or equipment. The nonsafety-related pipe tunnel (north pipe trench) connects the Unit 1 TB to the Unit 2 safety-related pipe tunnel that connects the auxiliary building to the fuel building north of the Unit 2 cable tunnel. The nonsafety-related tunnel is approximately 9 feet wide by 6 feet deep, and runs north from the Unit 2 safety-related pipe tunnel and then west to the Unit 1 TB. The nonsafety-related pipe tunnel is a reinforced concrete subsurface structure, and the top of the tunnel-covers are approximately level with grade.

The safety-related pipe tunnels contain safety-related components relied upon to remain functional during and following DBEs. In addition, the Unit 1 pipe tunnel performs functions that support fire protection. The Unit 2 nonsafety-related pipe tunnel (north pipe trench) includes an in-scope pipe support that is credited in the evaluation of nonsafety-related piping directly attached to safety-related piping.

LRA Table 2.4-19 identifies pipe tunnel component types within the scope of license renewal and subject to an AMR.

2.4.19.2 Staff Evaluation

The staff reviewed LRA Section 2.4.19 and UFSAR 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 2.4.19, the staff evaluated the structural component functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.19.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the pipe tunnel SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.20 Primary Demineralized Water Storage Tank Pad and Enclosure

2.4.20.1 Summary of Technical Information in the Application

In LRA Section 2.4.20, the applicant described the primary demineralized water storage tank pads and enclosures. The Unit 1 primary demineralized water storage tank pad and enclosure is a safety-related, seismic Category I structure approximately 38 feet by 41 feet by 45 feet high and is located in the yard west of the RCB. The enclosed tank supplies the AFW pumps. Also included with this structure are the nonsafety-related, nonseismic turbine plant demineralized water storage tank pad and the auxiliary demineralized water storage tank pad, which, similar to the primary demineralized water storage tank pad and enclosure, support tanks that supply the nonsafety-related dedicated AFW pump and that are within the scope of license renewal for fire protection concerns.

A reinforced concrete foundation pad three feet thick supports the primary demineralized water storage tank enclosure and the tank. The pad is above the PMF elevation. The walls of the enclosure are constructed of reinforced concrete two feet thick. The roof slab is the standard site tornado missile design for concrete depth and reinforcement but with permanent steel decking, supported by steel beams, for erection of the tank prior to installation of the roof. The walls and roof of the primary demineralized water storage tank pad enclosure are designed for design-basis tornado wind pressure and missile.

The turbine plant and auxiliary demineralized water storage tank pads are reinforced concrete foundations located higher than the standard project flood (El. 705 feet) but not the PMF, and the design of the two tanks is not for PMF flood conditions. Steel piles driven to the top of bedrock support the pad for the auxiliary demineralized water storage tank.

The Unit 2 primary demineralized water storage tank pad and enclosure is a safety-related, seismic Category I structure approximately 38 by 40 by 46 feet high located east of the safeguards building and south of the RWST.

The enclosed tank supplies the AFW pumps. Included with this structure is the nonsafety-related, nonseismic demineralized water storage tank pad that supports the nonsafety-related demineralized water storage tank that supplies additional water volume for the AFW system to support safe-shutdown.

The Unit 2 primary demineralized water storage tank and its enclosure are supported on a reinforced concrete foundation mat. The walls and roof of the enclosure are reinforced concrete. The roof slab is the standard site tornado missile design for concrete depth and reinforcement but with permanent steel decking, supported by steel beams, for erection of the tank prior to installation of the roof. The enclosure design is for tornado protection. A shake space separates the square pad for the primary demineralized water storage tank from the RWST. The pad is above the PMF elevation. The demineralized water storage tank pad is a reinforced concrete foundation similar in shape to a regular octagon but with only seven sides because two extend to form a square corner. The pad is above the PMF elevation and not adjacent to other structures.

The primary demineralized water storage tank pad and enclosure contains safety-related components relied upon to remain functional during and following DBEs. In addition, the primary demineralized water storage tank pad and enclosure performs functions that support fire protection.

LRA Table 2.4-20 identifies primary demineralized water storage tank pad and enclosure component types within the scope of license renewal and subject to an AMR.

2.4.20.2 Staff Evaluation

The staff reviewed LRA Section 2.4.20 and UFSAR 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 2.4.20, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the primary demineralized water storage tank pads and enclosures. Therefore, the staff issued RAIs to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAIs related to LRA Section 2.4.20, the corresponding applicant responses, and the staff evaluation.

In UFSAR Section 3.8.4.1.10 for Unit 2, the applicant discussed the primary demineralized water tank enclosure. However, the applicant's UFSAR references included in LRA Section 2.4.20 did not include UFSAR Section 3.8.4.1.10.

In RAI 2.4.20-1, dated June 4, 2008, the staff requested that the applicant clarify LRA Section 2.4.20.

In its response to RAI 2.4.20-1, dated July 24, 2008, the applicant revised LRA Section 2.4.20 to include as a reference, UFSAR Section 3.8.4.1.10 for Unit 2.

Based on its review, the staff finds the applicant's response to RAI 2.4.20-1 acceptable because the applicant has revised LRA Section 2.4.20 to include as a reference, UFSAR Section 3.8.4.1 for Unit 2. Therefore, the staff's concern described in RAI 2.4.20-1 is resolved.

In RAI 2.4.20-2, dated June 4, 2008, the staff requested that the applicant clarify the intended functions (missile barrier, fire barrier and flood barrier) for the components listed in LRA Table 2.4-20.

In its response to RAI 2.4.20-2, dated July 24, 2008, the applicant confirmed that (1) the missile barrier intended function for the roof slab of the Unit 1 primary demineralized water tank enclosure is missing from LRA Table 2.4-20 and revised LRA Tables 2.4-20 and 3.5.2-20 to correct this omission, (2) the Unit 2 primary demineralized water tank enclosure is not credited with a fire barrier intended function since there are no combustible materials located in proximity of the Unit 2 tank enclosure, and (3) the structural components of Unit 1 and 2 primary demineralized water tank enclosures do not have flood protection intended functions since the physical location of both tank enclosures is above the PMF level.

Based on its review, the staff finds the applicant's response to RAI 2.4.20-2 acceptable because the applicant has corrected LRA Tables 2.4-20 and 3.5.2-20 to include the missile barrier intended function for the roof slab of the Unit 1 primary demineralized water tank enclosure, and clarified the fire protection and flood barrier intended functions for the Unit 1 and 2 tank enclosures. Therefore, the staff's concern described in RAI 2.4.20-2 is resolved.

2.4.20.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the primary demineralized water storage tank pad and enclosure 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).

2.4.21 Primary Water Storage Building (Unit 1 Only)

2.4.21.1 Summary of Technical Information in the Application

In LRA Section 2.4.21, the applicant described the primary water storage building (Unit 1 only), a safety-related, seismic Category I structure approximately 64 by 50 by 13 feet high that is located east of the diesel generator building. There is no safety-related equipment in the building. The primary water storage building is a reinforced concrete structure designed for tornado protection. Carbon dioxide storage is located on the second (ground) floor of the building, just above grade.

The primary water storage building (Unit 1 only) performs functions that support fire protection.

LRA Table 2.4-21 identifies primary water storage building (Unit 1 only) component types within the scope of license renewal and subject to an AMR.

2.4.21.2 Staff Evaluation

The staff reviewed LRA Section 2.4.21 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 2.4.21, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the primary water storage building. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to LRA Section 2.4.21, the corresponding applicant responses, and the staff evaluation.

In LRA Section 2.4.21, the applicant stated that there is no safety-related equipment in the primary water storage building (also known as primary grade water pump room). Also, the applicant stated that the building is classified as safety-related and provides tornado protection.

In RAI 2.4.21-1, dated June 4, 2008, the staff requested that the applicant clarify the safety classification and intended functions of this building, and the classification of the equipment inside the building.

In its response to RAI 2.4.21-1, dated July 24, 2008, the applicant confirmed that the Unit 1 primary water storage building was originally designed as a safety-related structure because it contained safety-related equipment. The safety-related equipment has since been removed but the safety classification of the building was never downgraded.

Based on its review, the staff finds the applicant's response to RAI 2.4.21-1 acceptable because the applicant has clarified the classification of the Unit 1 primary water storage building and the equipment located inside this building. Therefore, the staff's concern described in RAI 2.4.21-1 is resolved.

2.4.21.3 Conclusion

The staff reviewed the LRA and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the primary water storage building (Unit 1 only) 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).

2.4.22 Reactor Containment Building

2.4.22.1 Summary of Technical Information in the Application

In LRA Section 2.4.22, the applicant described the RCBs. The Unit 1 RCB is a safety-related, seismic Category I structure entirely designated as QA Class I. It is a heavily reinforced concrete, steel-lined vessel with a flat base mat, cylindrical walls, and a hemispherical dome. The base mat is a soil-bearing concrete slab 10 feet thick without projections below its lower surface. A layer of porous concrete at least four inches thick underlying the mat consists of coarse aggregate bound with a water-cement paste. The inside diameter of the containment cylinder is 126 feet and the cylinder wall is 4'-6" inches thick. The distance from the top of the mat to the inside of the dome crown is approximately 185 feet. The dome has a thickness of 2'-6" inches and an inside radius of 63 feet. The inside faces of the containment wall, dome, and mat are lined with steel plates to make the RCB gas-tight.

The liner plate is anchored to the concrete containment. The steel liner is not credited for structural integrity of the containment shell. The containment internal structures consist of heavily reinforced concrete walls and slabs.

The containment exterior (shell) and the containment interior, consisting of the primary shield wall and crane wall connected by floors and radial walls and interior structural steel, are independent of one another and have different loading criteria. The exterior below-grade surface of the concrete shell and foundation mat has a continuous waterproofing membrane to protect the containment structure against water seepage during flood stages of the standard project flood elevation and the PMF elevation. As supplementary features, water relief systems are at two instrument pits outside the cylindrical containment wall. Concrete shafts extend from grade to the instrument pits in the top of the containment concrete foundation mat. The pits extend downward through the foundation mat into the porous concrete layer beneath it to indicate the presence of flood water penetrating the containment waterproof membrane. Accumulated water sets off an alarm in the control room. A spring 2006 steam generator replacement project removed an approximately 17 by 21-foot area on the south face of the RCB at El. 767'-0" to provide an access opening.

The Unit 2 RCB is a safety-related, seismic Category I reinforced concrete structure consisting of a cylindrical wall with a flat base and hemispherical dome completely lined with steel for support and strength against internal pressure and for vapor tightness. The distance between the top of the mat to the inside of the dome crown is approximately 185 feet. The 4'-6" inch thick cylindrical wall is about 122 feet high, and the 2'-6" thick dome has an inside radius of about 63 feet. The base mat is a soil-bearing concrete slab 10 feet thick. A layer of porous concrete at least four inches thick underlies the mat.

The containment exterior (shell and mat) structure and the containment internal structure of concrete and steel components are independent of one another and have different loading criteria. The containment is not integral to any of the surrounding structures. A shake space between the containment and the adjacent structures accommodates relative structural movement. The exterior below-grade surface of the concrete shell and foundation mat has a continuous waterproofing membrane to protect the containment structure against water seepage. As a supplementary feature, a water relief system of two open instrument pits in the floor of the safeguards area extend down to the porous concrete layer beneath the containment mat to indicate the presence of flood water penetrating the containment waterproof membrane. Accumulated water sets off an alarm in the control room. The containment internal structures consist of heavily reinforced concrete walls and slabs supporting the principal nuclear steam supply equipment.

The interior concrete also shields equipment and operating personnel from radiation, protects against missiles from component failure, provides restraint for various piping systems, and acts as a jet impingement barrier during postulated pipe breaks. Radial reinforced concrete walls extending between the primary shield wall and the crane wall (which supports the polar crane) separate the internals into cubicles which house three steam generators, RCPs, and the pressurizer. The containment floor, shell, dome, and interior concrete are passive heat sinks.

The RCB contains safety-related components relied upon to remain functional during and following DBEs. In addition, the RCB performs functions that support fire protection.

LRA Table 2.4-22 identifies RCB component types within the scope of license renewal and subject to an AMR.

2.4.22.2 Staff Evaluation

The staff reviewed LRA Section 2.4.22 and UFSAR 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 2.4.22, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the RCB. Therefore, the staff issued RAIs to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAIs related to the LRA Section 2.4.22, the corresponding applicant responses, and the staff evaluation.

In LRA Section 2.4.22, the applicant stated that the floor liner plate is installed on top of the foundation slab and is then covered with concrete.

In RAI 2.4.22-1, dated June 4, 2008, the staff requested that the applicant confirm that the inaccessible floor liner plate of the base mat, including the leak chase system and the concrete fill slab above this liner, are included in the components listed in LRA Table 2.4-22 and are subject to an AMR.

In its response to RAI 2.4.22-1, dated July 24, 2008, the applicant confirmed that the inaccessible floor liner plate of the base mat including the leak chase system and the concrete fill slab above this liner are included within the scope of license renewal and are subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.4.22-1 acceptable because the applicant has confirmed that the components in question are considered within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.4.22-1 is resolved.

In LRA Table 2.4.22, the applicant listed the equipment hatch, emergency air lock and personnel airlocks as containment components subject to an AMR.

In RAI 2.4.22-2, dated June 4, 2008, the staff requested that the applicant confirm that the hatch locks, hinges and closure mechanisms that help prevent loss of sealing and/or leak-tightness for these listed hatches are included within the scope of license renewal and subject to an AMR.

In its response to RAI 2.4.22-2, dated July 24, 2008, the applicant confirmed that all components (including fasteners, attachment devices, mechanical closure and locking mechanisms, hydraulic systems, valves, tubing and piping, and O-rings) of the equipment hatch, emergency air lock and personnel airlocks required to maintain structural integrity and to provide pressure boundary integrity are within the scope of license renewal for Unit 1 and 2 and are subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.4.22-2 acceptable because the applicant has confirmed that the components in question are considered within the scope of license renewal and are subject to an AMR. Therefore, the staff's concern described in RAI 2.4.22-2 is resolved.

In LRA Table 2.4-22 for the Unit 1 RCB, the staff noted that the applicant did not include blowout panels as a component subject to an AMR. The blowout panels are included in LRA Table 2.4-22 for the Unit 2 RCB.

In RAI 2.4.22-3, dated June 4, 2008, the staff requested that the applicant clarify the scoping difference between the Unit 1 and 2 RCBs relative to blowout panels.

In its responses to RAI 2.4.22-3, dated July 24, 2008 and August 22, 2008, the applicant confirmed that unlike the containment design for Unit 2, the Unit 1 containment design does not credit blowout panels, located in the incore instrument tunnel roof, for pressure relief. Therefore, blowout panels are not identified in LRA Table 2.4-22 for Unit 1 as an in-scope component subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.4.22-3 acceptable because the applicant has clarified that the Unit 1 containment design does not credit blowout panels for pressure relief and thus are not within the scope of license renewal nor subject to an AMR. Therefore, the staff's concern described in RAI 2.4.22-3 is resolved.

In LRA Table 2.4-22 for the Unit 2 RCB, the staff noted that the applicant did not include the vortex baffles and refueling cavity cofferdam as components subject to an AMR. The vortex baffles and refueling cavity cofferdam are included in LRA Table 2.4-22 for the Unit 1 RCB.

In RAI 2.4.22-4, dated June 4, 2008, the staff requested that the applicant clarify the scoping difference between the RCB for Unit 1 and 2 relative to these items.

In its responses to RAI 2.4.22-4, dated July 24, 2008 and August 22, 2008, the applicant confirmed that (1) Unit 2 does not have refueling cavity cofferdam, (2) the cofferdam function is no longer needed at either Unit 1 or 2 since the removable cavity seals have been replaced with a permanent one piece welded in-place seal, (3) vortex baffles have been removed from the Unit 1 containment sump, and vortex devices have been added to the Unit 2 containment sump as a result of recent modifications associated with Generic Safety Issue -191, "Assessment of Debris Accumulation on PWR Sump Performance," and Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors." In addition, the applicant revised LRA Tables 2.4-22 and 3.5.2-22 to reflect the changes in Unit 1 and 2 containment sumps.

Based on its review, the staff finds the applicant's responses to RAI 2.4.22-4 acceptable because the applicant has clarified the scoping relative to the Unit 2 refueling cavity cofferdam and corrected LRA Tables 2.4-22 and 3.5.2-22 to reflect the containment sump configuration. Therefore, the staff's concern described in RAI 2.4.22-4 is resolved.

In LRA Table 2.4-22, the staff could not determine whether the following components of the containment structure have been screened-in and subject to an AMR.

In RAI 2.4.22-5, dated June 4, 2008, the staff requested that the applicant clarify the inclusion of the following components in the scope of license renewal:

- Interior concrete floors
- Primary shield walls
- Grouted area between the neutron shield tank and primary shield wall
- Leak chase channels/angles that have been used at the containment liner welded joints (including those at penetrations)
- Leak chase system (if any) for the refueling cavity liner
- Floor and/or wall embedded plates and/or anchorages for RCS primary equipment (e.g., RV, pressurizer, steam generators, RCP)
- Reactor vessel support (foot) assembly (Unit 1 UFSAR Figure 5.2-2 and Unit 2 UFSAR Figure 5.4-10)
- Missile shields (Unit 1)

- Radiation shield panels (Unit 2)
- Penetration bellows (Unit 2)
- Neutron shields (Unit 2)
- Sheet piling and concrete wales shown in UFSAR Figure 5.1-5 (Unit 1) and Figure 3.8-6 (Unit 2)
- In reference to the Information Notice 98-26, the 4 inch (minimum) porous concrete sub-base under the containment base mat providing drainage for the emergency seepage removal system as described in UFSAR Sections 5.2.1 and 3.8.1.1.1 for Unit 1 and 2, respectively.
- Emergency seepage removal system, including concrete shafts extending from grade to the instrument pits located in the top of the containment foundation mat.

In its responses to RAI 2.4.22-5, dated July 24, 2008 and August 22, 2008, the applicant confirmed that:

- The containment interior concrete floors at both units are in-scope and subject to an AMR, and are evaluated under the component type "concrete framing" in LRA Table 2.4-22,
- The primary shield walls are in-scope and evaluated under the component type "interior walls" in LRA Table 2.4-22,
- The grouted area between the neutron shield tank and the primary shield wall is in-scope and evaluated under the component type "interior walls" in LRA Table 2.4-22,
- The leak chase channels/angles that have been used at the containment liner welded joints (including those at penetrations) are in-scope and evaluated under the component type "containment liner" in LRA Table 2.4-22,
- The leak chase channels for the refueling cavity liner are in-scope and evaluated under the component type "reactor cavity liner" in LRA Table 2.4-22. The associated piping for the reactor cavity liner leak chase system is in-scope and evaluated under the component type "piping" in LRA Section 2.3.3.19,
- The floor and/or wall embedded plates/anchorages for RCS primary equipment (e.g., RV, pressurizer, steam generators, RCP) are in-scope and evaluated under component types "anchorage / embedments" and "component and piping supports (ASME Code Class 1, 2 and 3)" in LRA Table 2.4-36,
- The RV support assemblies are in-scope and evaluated under component type "Component and Piping Supports (ASME Code Class 1, 2 and 3)," as bulk commodities, in LRA Table 2.4-36. The RV supports also include Lubrite® pads, which are listed in LRA Table 2-4-22 as "slide bearing plates,"
- The component "missile shields" is listed for Unit 2 in LRA Table 2.4-22 because stainless steel missile shields were installed for three fans in the Unit 2 containment, and because there is a concrete missile shield above the control rod drive housings. In Unit 1, there are no "missile shields" equivalent to the fan missile shields in Unit 2. Also, in Unit 1, the "missile shields" structure provided over the control rod drive mechanisms is a carbon steel plate, integral to the "control rod drive shield,"

- The component "radiation shield panels" is listed for Unit 1 in LRA Table 2.4-22 because shield panels were installed in an opening in the Unit 1 crane wall, across from the personnel hatch. There are no equivalent radiation shield panels in Unit 2,
- No penetration bellows are associated with the Unit 2 containment piping penetrations. The penetration bellows listed for Unit 1 are associated only with the recirculation spray heat exchangers river water outlet piping. No other piping penetrations include bellows,
- The Unit 2 neutron shields are in-scope and listed in LRA Table 2.4-22 under component type “neutron shield (supplementary),”
- The sheet piling and wales were used for initial construction. They had no function once construction was completed and therefore, are not subject to aging management review,
- Alumina cement was not used in the Unit 1 porous concrete mix design. Calcium aluminate (high alumina) cement was specified for the Unit 2 porous concrete mix design. However, the containment structures at both Unit 1 and 2 are founded well above the site’s normal groundwater level. The Unit 2 containment instrument pit sumps’ access shafts are located inside the safeguards building, and those sumps have remained dry. The porous concrete sub-bases under the containment base mats are water relief systems. The porous concrete sub-bases were evaluated as part of the containment foundation. Considering that the sub-base is above the groundwater table, a de-watering system is not used, and settlement has been found acceptable. In addition, the applicant stated that the erosion of cement from the porous concrete layer (i.e., loss of material) is not an aging effect requiring management.
- The systems in the porous concrete sub-foundation under the containment base mat described in Unit 1 UFSAR, Section 5.2.1, and Unit 2 UFSAR, Section 3.8.1.1.1, are water relief systems, as stated in the referenced UFSAR sections. The water relief system components are in-scope and are included as "instrument pits" in LRA Table 2.4-22.

In a follow-up September 3, 2008 teleconference with the applicant regarding Unit 2 containment with high alumina cement in porous concrete mix design, the staff requested that the applicant provide further information relative to the potential for rain water intrusion to cause erosion of porous concrete, and confirm that the electrical and mechanical components of the dewatering system are evaluated in other sections of the LRA. In its response, dated October 3, 2008, the applicant provided the following information:

- The Unit 1 and Unit 2 water relief systems each consist of open standpipes that extend into a nominal 4 inch thick porous concrete layer that exists beneath each unit's containment structure (included as part of the foundation for structural monitoring). The standpipes are considered "instrument pits" for the relief systems, since each contains level alarms to alert to the control rooms if water is filling the standpipes. Since the normal water table is approximately 10 feet or more below the containment mat's founding elevation (680'-11"), an alarm would be produced in the event of a flood and unexpected leakage through the waterproof membrane that encloses the containment structure to elevation 730'-0" (Probable Maximum Flood level). Both containment structures rest on a rubber membrane that is continuous and glued to the slab's perimeter and to the exterior containment wall surface up to an elevation of 730'-0". The waterproof membranes are in-scope for license renewal, but have no aging effects since ultraviolet light, ionizing radiation, ozone, or extreme thermal conditions do not exist for the waterproof membranes at either unit.

- The Updated Final Safety Analysis Report (UFSAR) for each unit states that the water relief system acts "as a supplementary safety factor" to prevent build-up of water pressure behind the steel containment liner during a flood if the membrane fails. This is a condition that is unlikely to occur, since the porous layer is separated from the liner by the ten (10) feet thick concrete foundation mat. The mat contains multiple (7) keyways in each of its vertical joints. The standpipe/pit openings are outside of the containment wall, and separated from the liner by 54 inches of wall concrete. Seepage through the poured in-place concrete wall-mat joint during the relatively short duration of a flood is improbable. Furthermore, the level alarms being lower in the standpipes, would result in the identification of any water rising in the standpipes before it reached the wall base at the top of the mat (690'-11"). Pumps would then be used to remove the water.
- At Unit 1, water has entered the instrument pits after prolonged or heavy rains, which causes the level alarm to activate in the control room. Operators then have the water removed using portable submersible pumps. It was concluded at the time of water accumulation that rain entered the shaft cover directly or through soil and then the shaft containment interface joint, and accumulated in the pit at the shaft's bottom. An accumulation causes the alarm to activate. No slurry has been reported during water removal. Unit 2 has not experienced water intrusion.
- The instrumentation (level alarms) in the emergency water relief pits is active equipment and not subject to aging management. The cables associated with the instruments are in-scope and are to be managed by the LRA Section B.2.11, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," program. There is no mechanical equipment associated with the subject instrument pits since accumulated water is removed using portable submersible pumps.

Based on its review, the staff finds the applicant’s responses to RAI 2.4.22-5 and follow-up questions relative to Units 1 and 2 containment porous concrete sub-foundation and water relief system acceptable because: (1) the applicant has confirmed the inclusion of all components (with the exception of the sheet piling and wales that were used for construction aid and have no intended functions for license renewal) listed in RAI 2.4.22-5 as within the scope of license renewal; (2) normal ground water table is approximately 10 feet or more below the bottom of the containment mat's founding elevation and an active dewatering system is not used; (3) the settlement for containment structures is within acceptable limit; (4) at the Unit 2 containment, where high alumina cement was used in porous concrete mix design, the instrument pit sumps’ access shafts are located inside the safeguards building, and has not experienced water intrusion; (5) both containment structures rest on a rubber membrane that is continuous and glued to the slab's perimeter and to the exterior containment wall surface up to an elevation of 730'-0"; (6) in the event of rising water in the standpipes, an alarm will sound in the control room. The water will then be removed by a sump pump; (7) conventional Portland cement (not calcium aluminate cement) was used in Unit 1 porous concrete mix design; therefore, the erosion of cement and degradation of porous concrete sub-foundation as described in Information Notices 97-11 and 98-26 is not applicable; (8) the level instrumentation associated with the water relief system are active components and not subject to an AMR; and (9) all other components associated with the water relief system (concrete shaft and electrical cables) are appropriately included in the scope of license renewal and subject to an AMR. Therefore, the staff’s concern described in RAI 2.4.22-5 is resolved.

2.4.22.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the RCB 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).

2.4.23 Refueling Water Storage Tank and Chemical Addition Tank Pad and Surroundings

2.4.23.1 Summary of Technical Information in the Application

LRA Section 2.4.23 describes the RWST and chemical addition tank pad and surroundings. The Unit 1 RWST and chemical addition tank pad is a safety-related, seismic Category I structure located west of the RCB. The pad and its shield wall are approximately 42 by 42 by 25 feet high. The two-foot thick pad and the shield wall are constructed of reinforced concrete. The concrete shielding around the RWST is one foot thick for adequate protection against damage from failure of the only rotating equipment in this area, the chemical addition tank pump and the chemical injection pumps. The concrete shielding, metal covering, and insulation protect the tank from fire. The distance from RWST to nonseismic structures in its vicinity and the concrete shielding provide adequate protection for the RWST. The elevation of the refueling water tank enclosure is higher than the PMF elevation.

The pad and shield walls surrounding the Unit 2 RWST and chemical addition tank are safety-related, seismic Category I structures approximately 56 by 57 by 16 feet high. The tanks are east of the Unit 2 safeguards building. The foundation mat supporting the tanks and the wall are constructed of reinforced concrete. The RWST foundation is five feet thick, and the 16-foot high concrete radiation protection shield surrounding the tank has a minimum thickness of one foot. The elevation of the tank foundation is above the PMF elevation.

The RWST and chemical addition tank pad and surroundings contain safety-related components relied upon to remain functional during and following DBEs. In addition, the RWST and chemical addition tank pad and surroundings performs functions that support fire protection.

LRA Table 2.4-23 identifies RWST and chemical addition tank pad and surroundings component types within the scope of license renewal and subject to an AMR.

2.4.23.2 Staff Evaluation

The staff reviewed LRA Section 2.4.23 and UFSAR 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 2.4.23, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the RWST and chemical addition tank pad and surroundings. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to the LRA Section 2.4.23, the corresponding applicant responses, and the staff evaluation.

In RAI 2.4.23-1, dated June 4, 2008, the staff requested that the applicant confirm that missile barrier, fire barrier and flood barrier are intended functions for the components in LRA Table 2.4-23.

In its response to RAI 2.4.23-1, dated July 24, 2008, the applicant confirmed that the missile barrier function was inadvertently omitted from the list of functions in LRA Section 2.4.23 for the Unit 1 RWST shield wall and revised LRA Section 2.4.23 and LRA Tables 2.4-23 and 3.5.2-23 to correct this omission. The applicant further confirmed that the Unit 1 RWST "shield wall" provides a fire barrier function due to its proximity to the 1B System Station Service Transformer. The applicant stated that the transformer is a source of combustible materials and is located less than 50 feet from the enclosure; therefore, a fire barrier is required. The applicant also confirmed that there are no combustibles within the proximity of the Unit 2 RWST, and that the Unit 2 shield wall is not credited with a fire barrier intended function. Lastly, the applicant confirmed that although a flood protection function was assigned to the RWST and chemical addition tank pad, no structural components were assigned a flood barrier function, since the physical location of the structures are above the PMF level.
Based on its review, the staff finds the applicant's response to RAI 2.4.23-1 acceptable because the applicant has adequately clarified whether the missile barrier, fire barrier and flood barrier are intended functions for the components in LRA Table 2.4-23 and revised the applicable sections of the LRA. Therefore, the staff's concern described in RAI 2.4.23-1 is resolved.

2.4.23.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the RWST and chemical addition tank pad and surroundings 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).

2.4.24 Relay Building (Common)

2.4.24.1 Summary of Technical Information in the Application

LRA Section 2.4.24 describes the Unit 1 and 2 relay building (common), a nonsafety-related, nonseismic structure which is part of the switchyard. This building houses the control circuits for the switchyard breakers within the scope of license renewal for offsite power recovery following SBO. The relay building is a single-story structure with an addition built onto the east end of the original building, circa 1980.

The foundations for the relay building and its addition are slabs on grade with perimeter footings. The top of the foundation/floor slab is at El. 751'-6". A 4mm polyethylene vapor barrier underlies the foundation slab for the original relay building and a pre-molded membrane vapor barrier underlies the floor slab for the addition. An electrical conduit and/or duct bank, encased in concrete, runs beneath a portion of the building addition's floor slab. A concrete-lined catch basin is at the northwest corner of the addition. Both the original building and the addition have exterior walls constructed of concrete block masonry with brick veneer. The roof for the original building is constructed of pre-cast concrete roof panels.

The roof for the addition consists of a lightweight concrete slab supported by metal decking and beams. A roof membrane covers both the original building and building addition roof slabs. The building addition's roof beams are encased with gypsum perlite plaster as fireproofing. Fire protection piping, in addition to domestic water and sanitary piping, penetrates the original relay building within a subsurface concrete compartment at its northwest corner. Equipment within the relay building is outside the 10 CFR 50.48 scope of required fire protection. The relay building provides structural or functional support for SBO.

LRA Table 2.4-24 identifies relay building (common) component types within the scope of license renewal and subject to an AMR.

2.4.24.2 Staff Evaluation

The staff reviewed LRA Section 2.4.24 and UFSAR 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 2.4.24, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the relay building. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to the LRA Section 2.4.24, the corresponding applicant responses, and the staff evaluation.

In LRA Section 2.4.24, the staff noted that the original building and the addition to the building have masonry block exterior walls. This description is not consistent with LRA Table 3.5.2-24 which lists the material for the exterior walls of the relay building as concrete.

In RAI 2.4.24-1, dated June 4, 2008, the staff requested that the applicant clarify this inconsistency.

In its response to RAI 2.4.24-1, dated July 24, 2008, the applicant confirmed that the exterior walls are masonry blocks (not poured concrete) and revised LRA Table 3.5.2-24 to correct this inconsistency.

Based on its review, the staff finds the applicant's response to RAI 2.4.24-1 acceptable because the applicant has confirmed that the exterior walls are masonry blocks and has corrected the inconsistency in LRA Table 3.5.2-4. Therefore, the staff's concern described in RAI 2.4.24-1 is resolved.

2.4.24.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the relay 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).

2.4.25 Safeguards Building

2.4.25.1 Summary of Technical Information in the Application

In LRA Section 2.4.25, the applicant described the safeguards buildings. The Unit 1 safeguards building is a safety-related, seismic Category I, two-story structure adjacent to and west of the Unit 1 RCB. The building has a deep valve pit and houses engineered safeguard systems (*e.g.*, the AFW system). A reinforced concrete foundation mat supports the safeguards building and baffles divide the floor of the safeguards area into two sections.

Piping connects the safeguards building to the RCB. A shake space accommodates movement relative to the containment. The safeguards valve pit attaches directly to the reactor containment mat. The valve pit connects to the upper part of the safeguards building by pump casements and a shaft. The pump casings and the access shaft are included within the butyl waterproof membrane surrounding the reactor containment for flood protection up to El. 730'. The elevation of the safeguards building is higher than the PMF elevation and not subject to flooding. A sump collects liquid from the floor drains. The sealed concrete surrounding the safeguards building prevents both entry of ground water and leakage of recirculation water from the safeguards area into the earth backfill between the cofferdam and the containment.

The Unit 2 safeguards building is a safety-related, seismic Category I structure approximately 60 by 106 and 59 feet high that protects the engineered safety feature pumps, valves, and piping penetrations from tornados. At El. 718'-6”, the safeguards building separates into two areas, north and south. All redundant components and equipment are physically separate in the two individual cubicles.

The Unit 2 safeguards building design precludes seismic, tornado, and missile damage. The building is a reinforced concrete structure supported on a reinforced concrete foundation mat. External flood protection is up to El. 730'. The Unit 2 safeguards building has a separate valve pit located below the main part of the building and joined by pump casements and two shafts. The same waterproof membrane that protects the containment building protects the pit from external flooding.

The safeguards buildings contain safety-related components relied upon to remain functional during and following DBEs. In addition, the safeguards buildings perform functions that support fire protection and SBO.

LRA Table 2.4-25 identifies safeguards building component types within the scope of license renewal and subject to an AMR.

2.4.25.2 Staff Evaluation

The staff reviewed LRA Section 2.4.25 and UFSAR 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 2.4.25, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the safeguards buildings. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to LRA Section 2.4.25, the corresponding applicant responses, and the staff evaluation.

In RAI 2.4.25-1, dated June 4, 2008, the staff requested that the applicant to clarify whether the Unit 2 recirculation spray coolers and associated shielding and supports are considered within the scope of license renewal or provide justification for their exclusion from the scope of license renewal.

In its response to RAI 2.4.25-1, dated July 24, 2008, the applicant clarified that the Unit 1 recirculation spray coolers are protected from a postulated pressurizer surge line break by a shield because they are located in the containment building. The Unit 2 recirculation spray coolers are located in the safeguards building, and do not require shielding. Consequently, no shield exists for the Unit 2 recirculation spray coolers. The recirculation spray coolers and associated supports are evaluated in LRA Sections 2.3.2.1 and 2.4.36, respectively.

Based on its review, the staff finds the applicant's response to RAI 2.4.25-1 acceptable because the applicant has confirmed that the recirculation spray coolers and associated supports are in scope and subject to an AMR and the Unit 2 recirculation spray coolers do not require shielding due to their location in the safeguard building. Therefore, the staff's concern described RAI 2.4.25-1 is resolved.

2.4.25.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the safeguards 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).

2.4.26 Service Building

2.4.26.1 Summary of Technical Information in the Application

In LRA Section 2.4.26, the applicant described the service buildings. The Unit 1 service building is a safety-related, seismic Category I structure which protects safety-related systems and components. Seismic Category I portions include part of the MCR, emergency switchgear and relay room, battery rooms, cable tray area, process room, and air conditioning equipment room for the MCR. The Unit 1 service building is a four-story structure with mezzanine levels, approximately 135 by 275 by 88 feet high, located adjacent to and south of the Unit 1 TB.

The Unit 1 service building foundation consists of a reinforced concrete mat founded on undisturbed gravel or compacted granular fill. Construction of the upper levels are of conventional steel framing, and the areas below the steel superstructure are of reinforced concrete designed for seismic and tornado loads. Roofing consists of a built-up membrane over steel decking supported by steel framing. Concrete floor slabs supported by steel or concrete framing can accommodate a collapse of the steel superstructure. The west end of the roof supports housing for a large structural steel and sheet metal air intake and radiator cooler. The service building exterior is either concrete or protected metal-fluted siding.

The service building is waterproofed and unaffected by floods to the PMF elevation. Equipment below the PMF elevation and essential for maintaining safe-shutdown is in watertight and missile-proof concrete structures.

The Unit 1 portion of the MCR is on the ground floor at the east end of the building. The Unit 2 portion of the MCR is in the Unit 2 control building (SER Section 2.4.7). A concrete wall two feet thick separates the MCR from other ground floor areas.

The control room is within a missile-proof concrete structure independently air-conditioned and protected against airborne radioactive contaminants. Structural steel beams below the cable tray area (cable spreading room), coated with a fireproof material, achieve a 1.5-hour fire-rated barrier. A vertical pipe chase extending from El. 698'-6" to the roof at El. 775'-6" in the northwest corner of the building contains main steam and feedwater piping.

The Unit 2 service building is a safety-related, seismic Category I, four-story structure which houses safety-related equipment and is approximately 54 by 186 by 70 feet high. The roof and portions of the walls of the top story are steel-framed with metal decking and siding. The remainder of the structure is reinforced concrete with a reinforced concrete foundation mat. The concrete walls and slabs protect against tornado and tornado-generated missiles. The steel framing is non-Category I and not designed for seismic or tornado loads. External flood protection is up to the PMF. Except for the seismic Category I battery room ductwork, all equipment at El. 760’-6” is nonseismic. If nonseismic Category I portions of the service building fail, no adverse effects on adjacent seismic Category I structures or components will occur.

The service buildings contain safety-related components relied upon to remain functional during and following DBEs. In addition, the service buildings perform functions that support fire protection and SBO.

LRA Table 2.4-26 identifies service building component types within the scope of license renewal and subject to an AMR.

2.4.26.2 Staff Evaluation

The staff reviewed LRA Section 2.4.26 and UFSAR 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 2.4.26, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant’s scoping and screening results for the service building. Therefore, the staff issued RAIs to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff’s RAs related to LRA Section 2.4.26, the corresponding applicant responses, and the staff evaluation.

In LRA Table 2.4-26 for the Unit 2 service building, the staff noted that the applicant did not include exterior walls below grade; thus, indicating that this building is a surface founded structure. Considering the pipe tunnel elevation and information in UFSAR Table 3.7B-2 for Unit 2, the staff issued RAI 2.4.26-1, dated June 4, 2008, requesting that the applicant provide justification for the exclusion of exterior walls below grade from the scope of license renewal.

In its response to RAI 2.4.26-1, dated July 24, 2008, the applicant confirmed that the Unit 2 service building is mainly surface founded and does not have an exterior wall below grade and in contact with soil.

Based on its review, the staff finds the applicant's response to RAI 2.4.26-1 acceptable because the applicant has confirmed that the Unit 2 service building has no exterior walls below grade; thus, there is no omission in LRA Table 2.4-26. Therefore, the staff's concern described in RAI 2.4.26-1 is resolved.

The staff reviewed UFSAR Figures 3.8-45 and 3.8-46 for Unit 2 and noted a sump pit in the Unit 2 service building.

In RAI 2.4.26-2, dated June 4, 2008, the staff requested that the applicant provide justification for the exclusion of Unit 2 service building sump pit(s) from the scope of license renewal.

In its response to RAI 2.4.26-2, dated July 24, 2008, the applicant confirmed that there is a sump pit in the foundation mat at the bottom of a pipe chase in the southeast corner of the Unit 2 service building. The applicant stated that the sump pit is considered within the scope of license renewal and is subject to an AMR. The applicant revised LRA Tables 2.4-26 and 3.5.2-26 to include the sump pit for Unit 2.

Based on its review, the staff finds the applicant's response to RAI 2.4.26-2 acceptable because the applicant has clarified that the Unit 2 sump pit is an in-scope component subject to an AMR and revised LRA Tables 2.4-26 and 3.5.2-26 to include this component. Therefore, the staff's concern described in RAI 2.4.26-2 is resolved.

2.4.26.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the service building SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.27 Solid Waste Building (Unit 1 Only)

2.4.27.1 Summary of Technical Information in the Application

In LRA Section 2.4.27, the applicant described the solid waste building (Unit 1 only), a safety-related, seismic Category I structure 40 by 120 by 47 feet high which is located directly east of the Unit 1 auxiliary building. This building houses the coolant recovery tanks and solid waste processing equipment. The solid waste building has reinforced concrete walls. The two coolant recovery tanks are at the north and south ends of the building. The foundation (*i.e.*, the main floor slab) is four feet thick. The foundation extends downward to enclose pipe and duct penetrations, near the center of the building. Structural steel framing supports the steel roof decking and the roof slab is 12 inches thick. There is a sump in the solid waste building but no equipment or floor drains. The building elevation is higher than the PMF elevation.

The solid waste building (Unit 1 only) contains safety-related components relied upon to remain functional during and following DBEs.

LRA Table 2.4-27 identifies solid waste building (Unit 1 only) component types within the scope of license renewal and subject to an AMR.

2.4.27.2 Staff Evaluation

The staff reviewed LRA Section 2.4.27 and UFSAR 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 2.4.27, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the solid waste building. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to the LRA Section 2.4.27, the corresponding applicant responses, and the staff evaluation.

In RAI 2.4.27-1, dated June 4, 2008, the staff requested that the applicant clarify the intended functions of the Unit 1 solid waste building for missile barrier to ensure compliance with 10 CFR 54.4(a)(1) and to maintain consistency with the intended functions listed in LRA Table 2.4-27.

In its response to RAI 2.4.27-1, dated July 24, 2008, the applicant confirmed that the Unit 1 solid waste building provides tornado missile protection for the coolant recovery tanks. LRA Section 2.4.27 was revised to add a missile barrier intended function.

Based on its review, the staff finds the applicant's response to RAI 2.4.27-1 acceptable because the applicant has verified that the Unit 1 solid waste building provides tornado missile protection for the coolant recovery tanks and corrected LRA Section 2.4.27 to maintain consistency with the intended functions listed in LRA Table 2.4-27. Therefore, the staff's concern described in RAI 2.4.27-1 is resolved.

2.4.27.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the solid waste building (Unit 1 only) 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).

2.4.28 South Office and Shops Building (Common)

2.4.28.1 Summary of Technical Information in the Application

In LRA Section 2.4.28, the applicant described the south office and shops building (common), a seven-story, nonsafety-related, seismic Category II steel frame structure adjacent to the southeast corner of the Unit 2 TB. This building houses offices and shops for engineering and maintenance groups that support both plant units. The Unit 2 auxiliary boiler room is in the south office and shops building but contains no components within the scope of license renewal. The south office and shops building, by design, will not collapse onto the TB under tornado or seismic loads (the TB otherwise could collapse onto safety-related structures). Therefore, only the major structural building systems (column and floor steel, bracing, roof deck and slab, fasteners, and anchorage) required for overall structural integrity are subject to an AMR.

The failure of nonsafety-related SSCs in the south office and shops building (common) could potentially prevent the satisfactory accomplishment of a safety-related function.

LRA Table 2.4-28 identifies south office and shops building (common) component types within the scope of license renewal and subject to an AMR.

2.4.28.2 Staff Evaluation

The staff reviewed LRA Section 2.4.28 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 2.4.28, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the south office and shops building. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to the LRA Section 2.4.28, the corresponding applicant responses, and the staff evaluation.

In RAI 2.4.28-1, dated June 4, 2008, the staff requested that the applicant provide justification for exclusion of floor slabs from the scope of license renewal.

In its responses to RAI 2.4.28-1, dated July 24, 2008 and August 22, 2008, the applicant confirmed that concrete floor slabs for the south office and shops building (common) at all elevations are within scope of license renewal and, and revised LRA Section 2.4.28 and Tables 2.4-28 and 3.5.2-28 to include floor slabs as an in-scope component subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.4.28-1 acceptable because the applicant has verified that the concrete floor slabs for the south office and shops building (common) are in-scope and revised the applicable LRA sections to correct the omission of concrete floor slabs. Therefore, the staff's concern described in RAI 2.4.28-1 is resolved.

2.4.28.3 Conclusion

The staff reviewed the LRA and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the south office and shops building (common) 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).

2.4.29 Steam Generator Drain Tank Structure (Unit 1 Only)

2.4.29.1 Summary of Technical Information in the Application

In LRA Section 2.4.29, the applicant described the steam generator drain tank structure (Unit 1 only), a nonsafety-related, nonseismic, triangular-shaped, reinforced concrete building, partitioned internally to form two separate stainless steel-lined tanks totally enclosed by an integral, reinforced concrete roof with a perimeter handrail and several access hatches. The structure is in a wedge-shaped area between the reactor containment and decontamination buildings. The tank structure, a late addition to the plant, was built primarily on an existing drum storage pad concrete slab but extends into the foundation slab of the decontamination building. The tanks hold water for treatment as liquid waste, during certain plant evolutions, prior to discharge. Piping for fill, drain, and level indications penetrates the wall facing the RCB. The structure is within the scope of license renewal because of its proximity to the reactor containment, fuel pool, and decontamination buildings.

The failure of nonsafety-related SSCs in the steam generator drain tank structure (Unit 1 only) could potentially prevent the satisfactory accomplishment of a safety-related function.

LRA Table 2.4-29 identifies steam generator drain tank structure (Unit 1 only) component types within the scope of license renewal and subject to an AMR.

2.4.29.2 Staff Evaluation

The staff reviewed LRA Section 2.4.29 and UFSAR 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 2.4.29, the staff evaluated the structural component functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.29.3 Conclusion

The staff reviewed the LRA and UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the steam generator drain tank structure (Unit 1 only) 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).

2.4.30 Switchyard (Common)

2.4.30.1 Summary of Technical Information in the Application

In LRA Section 2.4.30, the applicant described the switchyard (common), a nonsafety-related, nonseismic structure located south of the plant. The switchyard (including 138kV and 345kV switchyards) houses Duquesne Light Company (DLCo) system circuit breakers and relays connecting to the DLCo grid and forms a transmission switching point for the DLCo system. The two 138kV lines from the switchyard to the plant are on separate towers.

The Units 1 and 2 main transformers connect to the switchyard via transmission lines supported by towers. Switchyard structural components include towers and poles located outside the switchyard but supporting electrical transmission lines and connected to switchyard equipment via such lines. FirstEnergy Nuclear Generation Corp. owns some switchyard components and DLCo, a former owner, operator, and licensee, owns other switchyard components. The switchyard (common) provides structural or functional support for SBO.

LRA Table 2.4-30 identifies switchyard (common) component types within the scope of license renewal and subject to an AMR.

2.4.30.2 Staff Evaluation

The staff reviewed LRA Section 2.4.30 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 2.4.30, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.30.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the switchyard (common) 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).

2.4.31 Turbine Building

2.4.31.1 Summary of Technical Information in the Application

In LRA Section 2.4.31, the applicant described the TBs. The Unit 1 TB is a nonsafety-related, nonseismic structure adjacent to and north of the Unit 1 service building and adjacent to and east of the Unit 1 water treatment building. By design the TB superstructure will not collapse and endanger protected structures and systems.

The building houses secondary plant and fire protection equipment. The foundation or basement floor slab is below grade. Steel framing supports the mezzanine and operating floor slabs and roof decking. The TB has a built-up roof membrane on steel decking and is clad with insulated metal-fluted siding.

The Unit 2 TB is a nonsafety-related, nonseismic structure approximately 135 by 275 by 115 feet high enclosed with insulated metal siding and roof deck adjacent to and south of the auxiliary and service buildings. The TB houses secondary plant and fire protection equipment. The ground floor is a reinforced concrete slab. Reinforced concrete spread footings and foundation mats support the building and major equipment, including the turbine generator. The steel-framed TB has a built-up roof membrane on steel decking and is clad with insulated metal fluted siding designed to blow off under tornado loading to reduce wind loads on the superstructure. The ground floor slab is slightly above the PMF elevation. The mezzanine floor slab is at El. 752'-6" and the operating floor slab at El. 774'-6". In the event of internal flooding from a rupture of any circulating water system piping expansion joints in the TB, the building side panels release and discharge the water into the yard area before the water level reaches El. 735'-6" and affects other buildings or equipment.

The TB provides structural or functional support for fire protection.

LRA Table 2.4-31 identifies TB component types within the scope of license renewal and subject to an AMR.

2.4.31.2 Staff Evaluation

The staff reviewed LRA Section 2.4.31 and UFSAR 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 2.4.31, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the TB. Therefore, the staff issued RAIs to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAIs related to LRA Section 2.4.31, the corresponding applicant responses, and the staff evaluation.

In RAI 2.4.31-1, dated June 4, 2008, the staff requested that the applicant confirm that the intended function of the TB includes compliance with 10 CFR 54.4(a)(2), since this building is adjacent to safety-related structures and it is designed not to collapse.

In its response to RAI 2.4.31-1, dated July 24, 2008, the applicant verified that the intended function of the TB complies with 10 CFR 54.4(a)(2) and revised LRA Tables 2.4-31 and 3.5.2-31 to include 10 CFR 54.4(a)(2) intended function.

Based on its review, the staff finds the applicant's response to RAI 2.4.31-1 acceptable because the applicant has confirmed the intended function of the TB and corrected the LRA Tables 2.4.31 and 3.5.2-31. Therefore, the staff's concern described in RAI 2.4.31-1 is resolved.

In LRA Table 2.4-31 for Unit 2 TB, the staff noted that the applicant did not include exterior walls below grade.

In RAI 2.4.31-2, dated June 4, 2008, the staff requested that the applicant discuss Unit 2 TB exterior wall embedment below grade, considering the TB foundation elevation (715.3 feet) shown in LRA Figure 2.5.4-41 and final plant grade elevation of 735 feet shown in UFSAR Figure 2.5.4-8 for BVPS Unit 2; and, provide justification for the exclusion of exterior walls below grade from the scope of license renewal.

In its responses to RAI 2.4.31-2, dated July 24, 2008 and August 22, 2008, the applicant confirmed that Unit 2 TB does not have any exterior wall below grade, since this building is mainly at grade and has a perimeter grade beam which spans between reinforced concrete piers supporting steel columns. The applicant stated that the grade beam is evaluated as part of TB foundation and included in the LRA as an in-scope component and subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.4.31-2 acceptable because the applicant has clarified the TB elevation and foundation configuration and confirmed that the Unit 2 TB does not have any exterior wall below grade. Therefore, the staff's concern described in RAI 2.4.31-2 is resolved.

2.4.31.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the TB 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).

2.4.32 Valve Pit

2.4.32.1 Summary of Technical Information in the Application

In LRA Section 2.4.32, the applicant described the valve pits. The Unit 1 valve pit is a safety-related, seismic Category I, reinforced concrete, subsurface structure approximately 13 by 19.5 by 14 feet high, which houses safety-related equipment. The valve pit is divided into two separate compartments, each with its own manhole for access and a sump pit at its bottom.

The two Unit 2 service water valve pits are safety-related, seismic Category I, subsurface structures. One valve pit is approximately 14 by 20 by 15 feet high and located adjacent to the

Unit 2 safeguards building. The other is approximately 24 by 36 by 18 feet high and located northwest of the fuel and decontamination buildings. The valve pits house safety-related valves for service water piping that runs outside the major buildings. Reinforced concrete foundation mats support reinforced concrete walls and roofs. The valve pits protect their contents from tornados and have external flood protection up to the PMF elevation. The valve pit northwest of the fuel and decontamination buildings has two separate compartments, each with a sump pit.

Access is by two doors (one per compartment) to an above-ground concrete enclosure over the valve pit with two sealed plugs to provide access for equipment removal. Access to the valve pit adjacent to and north of the safeguards building is via removable sealed slabs.

The valve pits contain safety-related components relied upon to remain functional during and following DBEs. In addition, the Unit 2 valve pit provides structural or functional support for fire protection.

LRA Table 2.4-32 identifies valve pit component types within the scope of license renewal and subject to an AMR.

2.4.32.2 Staff Evaluation

The staff reviewed LRA Section 2.4.32 and UFSAR 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 2.4.32, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the valve pit. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to the LRA Section 2.4.32, the corresponding applicant responses, and the staff evaluation.

The staff reviewed LRA Section 2.4.32 and noted that a sump pit is located at the bottom of each compartment.

In RAI 2.4.32-1, dated June 4, 2008, the staff requested that the applicant confirm that the sump pit(s) are within the scope of license renewal and subject to an AMR or provide justification for the exclusion.

In its response to RAI 2.4.32-1, dated July 24, 2008, the applicant confirmed that the Unit 1 valve pit sump pit is within the scope of license renewal and subject to an AMR. The Unit 1 sump pit was not included in LRA Tables 2.4-32 and 3.5.2-32. The applicant revised LRA Tables 2.4-32 and 3.5.2-32 to include the Unit 1 sump pit as an in-scope component subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.4.32-1 acceptable because the applicant has confirmed that the Unit 1 sump pit is within the scope of license renewal and subject to an AMR, and revised LRA Tables 2.4-32 and 3.5.2-32 to reflect this change. Therefore, the staff's concern described in RAI 2.4.32-1 is resolved.

2.4.32.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the valve pit 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).

2.4.33 Waste Handling Building (Unit 2 Only)

2.4.33.1 Summary of Technical Information in the Application

In LRA Section 2.4.33, the applicant described the waste handling building (Unit 2 only), a nonsafety-related, seismic Category II, four-story plus basement structure. The waste handling building is approximately 40 by 112 by 77 feet high and is located adjacent to and west of the TB. This building contains no safety-related equipment. The foundation is a reinforced concrete mat, with the top two stories consisting of structural steel framing with metal siding and roof deck. The remainder of the structure is reinforced concrete. The failure of nonsafety-related SSCs in the waste handling building (Unit 2 only) could potentially prevent the satisfactory accomplishment of a safety-related function. The waste handling building (Unit 2 only) also provides structural or functional support for fire protection.

LRA Table 2.4-33 identifies waste handling building (Unit 2 only) component types within the scope of license renewal and subject to an AMR.

2.4.33.2 Staff Evaluation

The staff reviewed LRA Section 2.4.33 and UFSAR 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 2.4.33, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the waste handling building. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to the LRA Section 2.4.33, the corresponding applicant responses, and the staff evaluation.

The staff reviewed UFSAR Section 3.8.4.1.16 for Unit 2 and noted that the waste handling building is designed to provide biological shielding where required. However, LRA Table 2.4-33 does not include shielding as an intended function of components identified in this table.

In RAI 2.4.33-1, dated June 4, 2008, the staff requested that the applicant clarify the intended function of this building relative to biological shielding.

In its responses to RAI 2.4.33-1, dated July 24, 2008 and August 22, 2008, the applicant confirmed that (1) no plant personnel have a need to access the waste handling building for plant safe-shutdown or accident mitigation actions and (2) this structure is not credited with providing radiological shielding to plant personnel during or after an accident or for providing shielding in support of any 10 CFR 54.4(a)(1), (a)(2) or (a)(3) functions. Therefore, radiological shielding is not an intended function for the waste handling building.

Based on its review, the staff finds the applicant's response to RAI 2.4.33-1 acceptable because the applicant has confirmed that the Unit 2 waste handling building provides no license renewal intended function relative to biological shielding. Therefore, the staff's concern described in RAI 2.4.33-1 is resolved.

2.4.33.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the waste handling building (Unit 2 only) 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).

2.4.34 Water Treatment Building (Unit 1 Only)

2.4.34.1 Summary of Technical Information in the Application

In LRA Section 2.4.34, the applicant described the water treatment building (Unit 1 only), a nonsafety-related, nonseismic, two-story structure located adjacent to and west of the TB. The top floor is open to the TB. It houses equipment for filtering, demineralizing, and chemically treating river water. Water treatment is not required for safe-shutdown of the reactor. The top of the building's foundation, the ground floor slab, is at El. 707'-6" and rests on compacted sand and gravel. Structural steel framing supports the upper floor slab at El. 735'-6" and the roof at approximately El. 753'. Roofing consists of an insulated built-up membrane on steel decking. The building is clad in insulated metal-fluted siding. The water treatment building (Unit 1 only) provides structural or functional support for fire protection.

LRA Table 2.4-34 identifies water treatment building (Unit 1 only) component types within the scope of license renewal and subject to an AMR.

2.4.34.2 Staff Evaluation

The staff reviewed LRA Section 2.4.34 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 2.4.34, the staff evaluated the structural component functions described in the LRA to verify that the applicant has not omitted from the scope of license renewal any SCs with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those SCs that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived SCs subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4.34.3 Conclusion

The staff reviewed the LRA to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.
Based on its review, the staff concludes that the applicant has adequately identified the water treatment building (Unit 1 only) 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).

2.4.35 Yard Structures

2.4.35.1 Summary of Technical Information in the Application

In LRA Section 2.4.35, the applicant described the yard structures. The Unit 1, Unit 2, and common yard structures include slag pits and concrete (fire) walls for the Units 1 and 2 offsite power supply transformers, electrical equipment within the scope of license renewal, and their supports and foundations, respectively. Outside transformers are not within the scope of license renewal for the fire protection requirements of 10 CFR 50.48, but the concrete (fire) walls are within the scope of license renewal. The applicant credits outdoor lighting (with backup power from the security diesel generator) for ingress/egress in accordance with 10 CFR Part 50 Appendix R (fire protection) and SBO. Yard structures that support this function are lighting poles. The yard structures perform functions that support SBO.

LRA Table 2.4-35 identifies yard structures component types within the scope of license renewal and subject to an AMR.

2.4.35.2 Staff Evaluation

The staff reviewed LRA Section 2.4.35 and UFSAR 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 2.4.35, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the yard structures. Therefore, the staff issued a RAI to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAI related to the LRA Section 2.4.35, the corresponding applicant responses, and the staff evaluation.

The staff reviewed LRA Section 2.4.35 and noted that the concrete (fire) walls are included within the scope of license renewal. Under the heading of 10 CFR 54.4(a)(3), the applicant identified only SBO as an intended function.

In RAI 2.4.35-1, dated June 4, 2008, the staff requested that the applicant clarify the intended function of the yard structures relative to fire protection.

In its response to RAI 2.4.35-1, dated July 24, 2008, the applicant revised LRA Section 2.4.35 to include the fire protection intended function associated with the concrete fire walls around the yard area transformers.

Based on its review, the staff finds the applicant's response to RAI 2.4.35-1 acceptable because the applicant has corrected LRA Section 2.4.35 to include the fire protection intended function associated with the concrete fire walls around the yard area transformers. Therefore, the staff's concern described in RAI 2.4.35-1 is resolved.

2.4.35.3 Conclusion

The staff reviewed the LRA, UFSAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has 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).

2.4.36 Bulk Structural Commodities

2.4.36.1 Summary of Technical Information in the Application

In LRA Section 2.4.36, the applicant described the bulk structural commodities, structural component groups that support structures and mechanical and electrical systems within the scope of license renewal. They are common to multiple SSCs and share material and environment properties which allow a common program or inspection to manage their aging effects.

Structural commodities unique to a specific structure are evaluated with the structure. The evaluation of bulk structural commodities covered such structural component and commodity types as:

- Cranes, hoists, and miscellaneous monorails
- Service ladders, platforms, and stairs required for general access, equipment support, and maintenance activities
- Structural steel components common to systems and structures within the scope of license renewal (e.g., anchorage, baseplates, cable trays and conduits, equipment supports, framing, grating, panels and enclosures, and piping supports)
- Structural concrete components common to systems and structures within the scope of license renewal (e.g., equipment pads, floor curbs, and hatches)
- Elastomeric components common to systems and structures within the scope of license renewal (e.g., compressible joints and seals, roof membranes, and water stops)
- Fire barriers common to systems and structures within the scope of license renewal (e.g., fire doors, penetration fire seals, fireproofing, fire stops, and fire wraps)
- Miscellaneous materials common to systems and structures within the scope of license renewal (e.g., thermal insulation)

Bulk structural commodity categories:

- Steel and other metals
- Concrete
- Elastomers
- Fire Barriers
- Miscellaneous materials
- Threaded fasteners

Component types evaluated as bulk structural commodities support structures within the scope of license renewal. LRA Sections 2.4.1 through 2.4.35 list the intended functions for such structures with them.

LRA Table 2.4-36 identifies bulk structural commodities component types within the scope of license renewal and subject to an AMR.

2.4.36.2 Staff Evaluation

The staff reviewed LRA Section 2.4.36 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 2.4.36, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the bulk structural commodities. Therefore, the staff issued RAIs to determine whether the applicant properly applied the scoping criteria of 10 CFR 54.4(a) and the screening criteria of 10 CFR 54.21(a)(1). The following discussion describes the staff's RAIs related to the LRA Section 2.4.36, the corresponding applicant responses, and the staff evaluation.

The staff reviewed LRA Section 2.4.36 and noted that the applicant listed cranes, hoists and miscellaneous monorails as in-scope components.

In RAI 2.4.36-1, dated June 4, 2008, the staff requested that the applicant confirm that this component type includes all cranes, monorails, and/or hoists within the in-scope structures.

In its response to RAI 2.4.36-1, dated July 24, 2008, the applicant confirmed that the cranes, hoists and miscellaneous monorails located within safety-related structures, and that potentially could have an adverse interaction with safety-related SSCs resulting from seismic or heavy-lift events, are considered within the scope of license renewal and are subject to an AMR. The applicant also stated that those cranes, hoists and miscellaneous monorails that could have potential interaction with a regulated-event, 10 CFR 54.4(a)(3), or SSCs, are not considered for license renewal scoping or AMR. By letter dated August 22, 2008, the applicant provided further clarification relative to TB cranes and confirmed that the CLBs for Units 1 and 2 do not require consideration of interaction with TB cranes.

Based on its review and the guidance found in SRP-LR Table 2.1-2, the staff finds that a second level support system or a hypothetical failure need not be considered in determining the SSC within the scope of the rule in accordance with 10 CFR 54.4(a)(3). The staff further finds the applicant's response to RAI 2.4.36-1 acceptable because the applicant has confirmed that the TB cranes for Units 1 and 2 are not discussed in the CLB as having a possible adverse interaction with in-scope SSCs. Therefore, the staff's concern described in RAI 2.4.36-1 is resolved.

The staff reviewed LRA Table 2.4-36 and noted that the applicant included "Crane girders and rails" as a component type subject to an AMR.

In RAI 2.4.36-2, dated June 4, 2008, the staff requested that the applicant confirm that other relevant components of the cranes and monorails (bridge and trolley, rail hardware, etc.) are within the scope of license renewal and subject to an AMR.

In its response to RAI 2.4.36-2, dated July 24, 2008, the applicant confirmed that bridges, trolleys, rails, girders, and related hardware associated with the in-scope cranes are included within the scope of license renewal and are subject to an AMR.

Based on it review, the staff finds the applicant's response to RAI 2.4.36-2 acceptable because the applicant has verified the relevant subcomponents of the cranes and monorails as within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.4.36-2 is resolved.

In RAI 2.4.36-3, dated June 24, 2008, the staff requested that the applicant confirm whether the following component types apply to the Units 1 and 2 and; therefore, screened in and subject to an AMR or provide the basis for their exclusion from the scope of license renewal.

- Grout pads for equipment and support (including building columns) base plates
- Vibration Isolators (if any) at the interface between the equipment and the support structure
- Steel or concrete missile shields and associated supports (support members, welds, bolts, etc.)
- Tank Foundations
- Battery Racks
- Plant Vent Stack
- Radiation Shield Panels

In its response to RAI 2.4.36-3, dated July 24, 2008, the applicant confirmed that:

- Grout pads are included with the bulk commodity "Equipment Pads" in LRA Section 2.4.36. Structural grout (column base plates) is grouped with concrete.
- Vibration Isolators at the interface between the equipment and the support structures are included with "Equipment Pads" in LRA Section 2.4.36.
- Components are specifically called "Missile shields" only when they perform no other structural function. Missile shields are not evaluated with bulk structural commodities and they are included in LRA sections for in-scope structure. The associated component supports, however, are included within LRA Section 2.4.36 (Bulk commodities) as "Equipment component supports."

- Tank foundation concrete is not evaluated with bulk structural commodities. They are evaluated for AMR separately in LRA sections for in-scope tanks.
- Battery racks in LRA Sections 2.4.12, "Emergency Response Facility (ERF) Substation Building," and in 2.4.16, "Guard House (Common)," are called "Battery racks." Battery racks in the Unit 1 and Unit 2 service buildings are grouped with "Instrument racks and frames" as a commodity in LRA Section 2.4.36.
- Units 1 and 2 do not have a structural vent stack. Ventilation exhausts that extend above building roofs are evaluated as "Duct" within a mechanical ventilation system in LRA Section 2.3.3.32, "Supplementary Leak Collection and Release System."
- "Hatches" that perform a shielding function are included with bulk commodities in LRA Section 2.4.36. Other radiation shielding panels - such as those in the Reactor Containment Building for Unit 1, are not included with bulk commodities, but rather, were subject to AMR as separate components in LRA Section 2.4.22, "Reactor Containment Building."

Based on its review, the staff finds the applicant's response to RAI 2.4.36-3 acceptable because the applicant has confirmed that the above items have not been omitted from the scope of license renewal. Therefore, the staff's concern described in RAI 2.4.36-3 is resolved.

2.4.36.3 Conclusion

The staff reviewed the LRA and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the bulk structural commodities SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

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

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

- electrical and I&C component commodity groups

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

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

In its scoping evaluation, the staff reviewed the applicable LRA sections and letters dated July 11, 2008 and August 13, 2008, focusing on components that have not been identified as within the scope of license renewal.
The staff reviewed the UFSAR for each electrical and I&C system to determine whether the applicant has omitted from the scope of license renewal, components with intended functions pursuant to 10 CFR 54.4(a).

After its review of the scoping results, the staff evaluated the applicant's screening results. For those SCs with intended functions, the staff sought to determine whether (1) the functions are performed with moving parts or a change in configuration or properties or (2) the SCs are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff sought to confirm that these SCs were subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.1 Electrical and Instrumentation and Controls Systems

2.5.1.1 Summary of Technical Information in the Application

In LRA Section 2.5.1, the applicant described 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 bounding approach for the review of plant environments eliminates the need to indicate each unique component and its specific location and precludes improper exclusion of components from an AMR.

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

- cable connections (metallic parts)
- electrical cables and connections not subject to 10 CFR 50.49 EQ requirements
- electrical cables and connections not subject to 10 CFR 50.49 EQ requirements in instrumentation circuits
- electrical connections not subject to 10 CFR 50.49 EQ requirements exposed to borated water leakage
- fuse holders - insulation material
- high-voltage insulators
- inaccessible medium-voltage (2kV to 35kV) cables (*e.g.*, underground in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements
- metal enclosed bus (nonsegregated bus), bus/connections (Unit 2)
- metal enclosed bus (nonsegregated bus), enclosure assemblies (Unit 2)

- metal enclosed bus (nonsegregated bus), insulation/insulators (Unit 2)
- switchyard bus (switchyard bus for SBO recovery) and connections (Unit 1)
- transmission conductors (transmission conductors for SBO recovery) and connections

The intended functions of the electrical and I&C systems component types within the scope of license renewal include:

- electrical connections to electrical circuit sections for voltage, current, or signal delivery
- electrical conductor insulation and support
- structural or functional support to safety-related equipment

2.5.1.2 Staff Evaluation

The staff reviewed LRA Section 2.5.1 and UFSAR Sections 7 and 8 for both Units 1 and Unit 2 using the evaluation methodology described in SER Section 2.5 and the guidance in SRP-LR Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Controls Systems."

During its review of LRA Section 2.5.1 and UFSAR Sections 7 and 8 for both Unit 1 and Unit 2, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions pursuant to 10 CFR 54.4(a). The staff then reviewed those components that the applicant has 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 must be supplied by two physically independent circuits to minimize the likelihood of their simultaneous failure. In addition, the staff noted that the guidance it had provided by letter dated April 1, 2002, "Staff Guidance on Scoping of Equipment Relied on to Meet the Requirements of the Station Blackout Rule (10 CFR 50.63) for License Renewal (10 CFR 54.4(a)(3))," and later incorporated in SRP-LR Section 2.5.2.1.1 states:

> For purposes of the license renewal rule, the staff has determined that the plant system portion of the offsite power system that is used to connect the plant to the offsite power source should be included within the scope of the rule. This path typically includes switchyard circuit breakers that connect to the offsite system power transformers (startup transformers), the transformers themselves, the intervening overhead or underground circuits between circuit breaker and transformer and transformer and onsite electrical system, and the associated control circuits and structures. Ensuring that the appropriate offsite power system long-lived passive SCs 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.

Because the FENOC application includes the complete circuits between the onsite circuits and up to and including the switchyard circuit breakers and associated controls and structures, the staff concludes that the intent of the guidance issued April 1, 2002 is met.

2.5.1.3 Conclusion

The staff reviewed the LRA with amendments and the UFSAR to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions.

Based on its review, the staff concludes that the applicant has adequately identified the electrical and I&C systems components within the scope of license renewal, as required by

10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1) and; therefore, is acceptable.

2.6 Conclusion for Scoping and Screening

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

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

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

SECTION 3

AGING MANAGEMENT REVIEW RESULTS

This Section of the safety evaluation report (SER) evaluates aging management programs (AMPs) and aging management reviews (AMRs) for Beaver Valley Power Station (BVPS) Units 1 and 2, by the staff of the United States 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 42 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.

BVPS Units 1 and 2 are constructed of similar materials with similar environments. Therefore, the mechanical system and component information presented in the LRA typically applies to both units, and no unit-specific identifier is listed. However, design differences exist between Units 1 and 2. Those design differences are identified by using a designator (i.e., Unit 1 only or Unit 2 only). Further, BVPS assigned a different designator (i.e., common) for those cases in where the system, structure, or component (SSC) is used and/or shared by both units.

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

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 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, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), dated September 2005, was prepared based on both the GALL Report model and lessons learned from the demonstration project.

The staff 's review was in accordance with Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," and the guidance of the SRP-LR and the GALL Report.

In addition to its review of the LRA, the staff conducted an onsite audit of associated AMPs, during the week of March 3-7, 2008. 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 April 7, 2003. This revised LRA format incorporates lessons learned from the staff's reviews of the previous five 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 AMR results 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 BVPS application is essentially the same. The intent of the revised format of the LRA for BVPS was to modify the tables in LRA Section 3 to provide additional information that would assist in the staff's review. In its Table 1s, the applicant summarized the portions of the application that it considered to be consistent with the GALL Report. In its Table 2s, the applicant identified the linkage between the scoping and screening results in LRA Section 2 and the AMRs in LRA Section 3.

3.0.1.1 Overview of Table 1s

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

- further evaluation recommended - information or reference to where that information is located
- The name of a plant-specific program
- exceptions to GALL Report assumptions
- discussion of how the line is consistent with the corresponding line item in the GALL Report when the consistency may not be obvious
- discussion of how the item is different from the corresponding line item in the GALL Report (*e.g.*, when an exception is taken to a GALL Report AMP)

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

3.0.1.2 Overview of Table 2s

Each Table 2 provides the detailed results of the AMRs for components identified in LRA Section 2 as subject to an AMR. The LRA has a Table 2 for each of the systems or structures within a specific system grouping (*e.g.*, reactor coolant system (RCS), engineered safety features (ESF), auxiliary systems, etc.). For example, the ESF group has tables specific to the containment spray system, containment isolation system, and emergency core cooling system. Each Table 2 consists of nine columns:

- Component Type – The first column lists LRA Section 2 component types subject to an AMR in alphabetical order.
- 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.
- Material – The third column lists the particular construction material(s) for the component type.
- Environment – The fourth column lists the environments to which the component types are exposed. Internal and external service environments are indicated with a list of these environments in LRA Tables 3.0-1, 3.0-2, and 3.0-3.
- Aging Effect Requiring Management – The fifth column lists aging effects requiring management (AERMs). As part of the AMR process, the applicant determined any AERMs for each combination of material and environment.
- Aging Management Programs – The sixth column lists the AMPs that the applicant uses to manage the identified aging effects.
- 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 are no corresponding items in the GALL Report, the applicant leaves the column blank in order to identify the AMR results in the LRA tables corresponding to the items in the GALL Report tables.

- 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 line 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.
- 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 line item with the GALL Report.

3.0.2 Staff's Review Process

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

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

The SRP-LR states that an applicant may take one or more exceptions to specific GALL AMP elements; however, any deviation from or exception to the GALL AMP should be described and justified. Therefore, the staff considers exceptions as being portions of the GALL AMP that the applicant does not intend to implement.

In some cases, an applicant may choose an existing plant program that does not meet all the program elements defined in the GALL AMP. However, the applicant may make a commitment to augment the existing program to satisfy the GALL AMP prior to the period of extended operation. Therefore, the staff considers these augmentations or additions to be enhancements. Enhancements include, but are not limited to, activities needed to ensure consistency with the GALL Report recommendations. Enhancements may expand, but not reduce, the scope of an AMP.

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

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

3.0.2.1 Review of AMPs

For AMPs for which the applicant claimed consistency with the GALL AMPs, the staff conducted either an audit or a technical review to verify the claim. For each AMP with one or more deviations, the staff evaluated each deviation to determine whether the deviation was acceptable and whether the modified AMP would adequately manage the aging effect(s) for which it was credited. For AMPs not evaluated in the GALL Report, the staff performed a full review to determine their adequacy. The staff evaluated the AMPs against the following 10 program elements defined in SRP-LR Appendix A.

(1) Scope of 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 intended function(s).

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

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

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

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

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

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

(10) Operating Experience – Operating experience of the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the SC intended function(s) will be maintained during the period of extended operation.

Details of the staff's audit evaluation of program elements (1) through (6) are documented in SER Section 3.0.3.

The staff reviewed the applicant's quality assurance (QA) program and documented its evaluations in SER Section 3.0.4. The staff's evaluation of the QA program included assessment of the "corrective actions," "confirmation process," and "administrative controls" program elements.

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

3.0.2.2 Review of AMR Results

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

3.0.2.3 UFSAR Supplement

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

3.0.2.4 Documentation and Documents Reviewed

In its review, the staff used the LRA, LRA supplements, the SRP-LR, and the GALL Report. During the onsite audit, the staff also examined the applicant’s justifications to verify that the applicant’s activities and programs will adequately manage the effects of aging on SCs. The staff also conducted detailed discussions and interviews with the applicant’s license renewal project personnel and others with technical expertise relevant to aging management.

3.0.3 Aging Management Programs

SER Table 3.0.3-1 presents the AMPs credited by the applicant and described in LRA Appendix B. The table also indicates the SSCs that credit the AMPs and the GALL AMP with which the applicant claimed consistency and shows the Section of this SER in which the staff’s evaluation of the program is documented.

Table 3.0.3-1 BVPS Aging Management Programs

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff’s SER Section
10 CFR Part 50, Appendix J Program (B.2.1)	Existing	Consistent	XI.S4	containments, structures, and component supports	3.0.3.1.1

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program (B.2.2)	Existing	Consistent with exceptions	XI.M1	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.2.1
ASME Section XI, Subsection IWE Program (B.2.3)	Existing	Consistent with exceptions	XI.S1	containments, structures, and component supports	3.0.3.2.2
ASME Section XI, Subsection IWF Program (B.2.4)	Existing	Consistent with exceptions	XI.S3	containments, structures, and component supports	3.0.3.2.3
ASME Section XI, Subsection IWL Program (B.2.5)	Existing	Consistent	XI.S2	containments, structures, and component supports	3.0.3.1.2
Bolting Integrity Program (B.2.6)	Existing	Consistent	XI.M18	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion systems	3.0.3.1.3
Boric Acid Corrosion Program (B.2.7)	Existing	Consistent	XI.M10	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion systems / containments, structures, and component supports / electrical and instrumentation and controls	3.0.3.1.4
Buried Piping and Tanks Inspection Program (B.2.8)	New	Consistent with exceptions	XI.M34	auxiliary systems / steam and power conversion systems	3.0.3.1.5
Closed-Cycle Cooling Water System Program (B.2.9)	Existing	Consistent with enhancements	XI.M21	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion systems	3.0.3.2.4

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program (B.2.10)	New	Plant-specific		electrical and instrumentation and controls	3.0.3.3.1
Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.11)	New	Consistent	XI.E1	electrical and instrumentation and controls	3.0.3.1.6
Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (B.2.12)	New	Consistent	XI.E2	electrical and instrumentation and controls	3.0.3.1.7
Electrical Wooden Poles/Structures Inspection Program (Unit 2 only) (B.2.13)	New	Plant-specific		containments, structures, and component supports	3.0.3.3.2
Environmental Qualification (EQ) of Electrical Components Program (B.2.14)	Existing	Consistent	X.E1	electrical and instrumentation and controls	3.0.3.1.8
External Surfaces Monitoring Program (B.2.15)	New	Consistent	XI.M36	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion systems	3.0.3.1.9
Fire Protection Program (B.2.16)	Existing	Consistent with exceptions and enhancements	XI.M26	auxiliary systems / containments, structures, and component supports	3.0.3.2.5
Fire Water System Program (B.2.17)	Existing	Consistent with enhancements	XI.M27	auxiliary systems	3.0.3.2.6

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Flow-Accelerated Corrosion Program (B.2.18)	Existing	Consistent	XI.M17	auxiliary systems / steam and power conversion systems	3.0.3.1.10
Flux Thimble Tube Inspection Program (B.2.19)	Existing	Consistent with enhancement	XI.M37	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.2.7
Fuel Oil Chemistry Program (B.2.20)	Existing	Consistent with exceptions and enhancements	XI.M30	auxiliary systems	3.0.3.2.8
Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B.2.21)	New	Consistent	XI.E3	electrical and instrumentation and controls	3.0.3.1.11
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (B.2.22)	New	Consistent	XI.M38	engineered safety features / auxiliary systems / steam and power conversion systems	3.0.3.1.12
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program (B.2.23)	Existing	Consistent with enhancements	XI.M23	containments, structures, and component supports	3.0.3.2.9
Lubricating Oil Analysis Program (B.2.24)	Existing	Consistent	XI.M39	auxiliary systems / steam and power conversion systems	3.0.3.1.13
Masonry Wall Program (B.2.25)	Existing	Consistent with enhancement	XI.S5	containments, structures, and component supports	3.0.3.2.10
Metal Enclosed Bus Program (Unit 2 only) (B.2.26)	New	Consistent	XI.E4	electrical and instrumentation and controls	3.0.3.1.14
Metal Fatigue of Reactor Coolant Pressure Boundary Program (B.2.27)	Existing	Consistent	X.M1	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion systems	3.0.3.1.15

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads Program (B.2.29)	Existing	Consistent	XI.M11A	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.1.16
One-Time Inspection Program (B.2.30)	New	Consistent	XI.M32	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion systems	3.0.3.1.17
One-Time Inspection of ASME Code Class 1 Small Bore Piping Program (B.2.31)	New	Consistent	XI.M35	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.1.18
Open-Cycle Cooling Water System Program (B.2.32)	Existing	Consistent	XI.M20	engineered safety features / auxiliary systems / steam and power conversion systems	3.0.3.1.19
Reactor Head Closure Studs Program (B.2.34)	Existing	Consistent with exceptions	XI.M3	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.2.11
Reactor Vessel Integrity Program (B.2.35)	Existing	Plant-specific		reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.3.4
Selective Leaching of Materials Inspection Program (B.2.36)	New	Plant-specific		auxiliary systems / steam and power conversion systems	3.0.3.3.6
Settlement Monitoring Program (Unit 2 only) (B.2.37)	Existing	Plant-specific		containments, structures, and component supports	3.0.3.3.5
Steam Generator Tube Integrity Program (B.2.38)	Existing	Consistent	XI.M19	reactor vessel, reactor vessel internals, and reactor coolant system	3.0.3.1.21
Structures Monitoring Program (B.2.39)	Existing	Consistent with enhancements	XI.S6	containments, structures, and component supports / electrical and instrumentation and controls	3.0.3.2.12

AMP (LRA Section)	New or Existing AMP	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B.2.41)	New	Consistent	XI.M12	reactor vessel, reactor vessel internals, and reactor coolant system / auxiliary systems / steam and power conversion systems	3.0.3.1.23
Water Chemistry Program (B.2.42)	Existing	Consistent with enhancement	XI.M2	reactor vessel, reactor vessel internals, and reactor coolant system / engineered safety features / auxiliary systems / steam and power conversion systems / containments, structures, and component supports	3.0.3.2.13
Boral® Surveillance Program (B.2.43)	New	Plant specific		Unit 1 Spent Fuel Pool	3.0.3.3.7

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
- ASME Section XI, Subsection IWL Program
- Bolting Integrity Program
- Boric Acid Corrosion Program
- Buried Piping and Tanks 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
- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program

- Metal Enclosed Bus Program (Unit 2 only)
- Metal Fatigue of Reactor Coolant Pressure Boundary Program
- Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads Program
- One-Time Inspection Program
- One-Time Inspection of ASME Code Class 1 Small Bore Piping Program
- Open-Cycle Cooling Water System Program
- PWR Vessel Internals Program
- Steam Generator Tube Integrity Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

3.0.3.1.1 10 CFR Part 50, Appendix J Program

Summary of Technical Information in the Application. In LRA Section B.2.1, the applicant describes the existing 10 CFR Part 50, Appendix J Program as consistent with GALL AMP XI.S4, "10 CFR 50, Appendix J." The applicant uses Option B, the performance-based approach, to implement the requirement of containment leak rate monitoring and testing.

The 10 CFR 50, Appendix J Program monitors leakage rates through the containment pressure boundary, including penetrations and access openings. Containment leak rate tests assure that leakage through the primary containment and systems and components penetrating primary containment does not exceed acceptance criteria limits.

Staff Evaluation. During the audit, the staff interviewed the applicant's technical staff and audited its 10 CFR Part 50, Appendix J Program onsite basis documents to determine the consistency with GALL AMP XI.S4. Specifically, the staff reviewed the program elements and associated onsite documents and found that they are consistent with the GALL AMP.
The staff noted that in 10 CFR Part 50, Appendix J Program, the applicant utilizes Option B, the performance-based approach, to implement the containment integrated leak rate test (ILRT). The staff was aware that a temporary construction opening was created for the Unit 1 steam generator (SG) and reactor head replacements during refueling outage (RFO) 17 (2006). Inspections revealed degradation from the inaccessible side of steel liner for which the applicant could not identify a root-cause, either from field observations or lab analysis. The staff further noted that since the relaxation of Option B ILRT frequency for 15 years is based on the risk impact assessment, the applicant must assess the risk impact, incorporating the liner corrosion on the inaccessible side, based on the 2006 findings.

In Request for Additional Information (RAI) B.2.1-1, dated May 8, 2008, the staff requested that the applicant provide information relating to the risk impact of the liner corrosion on the inaccessible side, based on the 2006 findings.

In its response to RAI B.2.1-1, dated June 16, 2008, the applicant stated that it had included an evaluation of the risk of an unidentified through-wall leak in the containment liner due to corrosion in the applicant's submittal for a one-time 15-year test interval in 2003, which was approved by the staff. The applicant further stated that the risk assessment performed to evaluate the risk of extending the ILRT frequency, no longer applied following the 2006 ILRT, and that Unit 1 returned to the normal Option B ILRT frequency of once every 10 years.

Based on its review, the staff finds the applicant's response to RAI B.2.1-1 acceptable because the current ILRT test interval returned to the normal interval in accordance with the guidance found in NEI 94-01, as endorsed by Regulatory Guide (RG) 1.163, for a frequency of once every 10 years, without extension. Therefore, the staff's concern described in RAI B.2.1-1 is resolved.

The staff also noted that the applicant must conduct a visual examination of accessible interior and exterior surfaces of the containment system, prior to initiating an ILRT. The staff further noted that the purpose of the visual examination is to detect and repair, if necessary, structural degradation before an ILRT is performed, since steel liner degradation may exist on the inaccessible side at Units 1 and 2.

In RAI B.2.1-2, dated May 8, 2008, the staff requested that the applicant provide information how it addressed possible degradation on the outside of the liner during the ILRT pretest procedure.

In a letter dated June 16, 2008, in response to RAI B.2.1-2, the applicant explained that two additional requirements were incorporated into the containment inspection procedures as a result of the liner corrosion found in 2006: (1) When paint or coatings are to be removed for further inspection, the paint or coatings shall be visually examined by a qualified VT-3 inspector prior to removal, and (2) If the visual examination detects surface flaws on the liner or suspect areas on the liner plate that could potentially impact the leak tightness or structural integrity of the liner, then surface or volumetric examinations shall be performed to characterize the condition (*i.e.*, depth, size, shape, orientation). The applicant also stated that evidence of structural deterioration which may affect either the containment structural integrity or leak-tightness is entered into the FENOC Corrective Action Program.

Based on its review, the staff finds the applicant's response to RAI B.2.1-2 acceptable because the applicant's implementation of the above-mentioned additional requirements during the subsequent inspections, as well as the ILRT will provide assurance that the containment liners at BVPS will continue to perform their intended functions for the period of extended operation. Therefore, the staff concern described in RAI B.2.1-2 is resolved.

<u>Operating Experience</u>. The staff also reviewed the operating experience, including samples of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The staff noted that there were no instances of Appendix J test failures due to causes other than valve or flange seat leakage. For these failures, all conditions were evaluated and corrected.

The staff confirmed that the operating experience program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

<u>UFSAR Supplement</u>. In LRA Section A.1.1, the applicant provided the UFSAR supplement for the 10 CFR 50 Appendix J Program. The staff reviewed this Section and determines that the

information in the UFSAR 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 and additional information provided in the applicants RAI responses, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and determines that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 ASME Section XI, Subsection IWL Program

Summary of Technical Information in the Application. In LRA Section B.2.5, the applicant described the existing ASME Section XI, Subsection IWL Program as consistent with GALL AMP XI.S2, "ASME Section XI, Subsection IWL."

The ASME Section XI, Subsection IWL Program consists of periodic visual inspections of the reinforced concrete containment structures for Units 1 and 2.

Staff Evaluation. During its audit, the staff interviewed the applicant's technical staff and audited the applicant's ASME Section XI, Subsection IWL Program onsite basis documents to determine their consistency with GALL AMP XI.S2. Specifically, the staff reviewed the program elements and associated onsite documents and found that they are consistent with the GALL AMP. Based on its review, the staff concluded that the applicant's ASME Section XI, Subsection IWL Program provides assurance that the reinforced concrete containment structures will be adequately managed. The staff finds the applicant's ASME Section XI, Subsection IWL Program acceptable because it conforms to the recommended GALL AMP XI.S2.

Operating Experience. The staff reviewed the operating experience, including samples of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. In the LRA, the applicant explained that the operating experience of the ASME Section XI, Subsection IWL Program activities shows no adverse trend of containment performance. Previous IWL inspections for Units 1 and 2 have identified minor issues such as mildew and rust stains, spalling, surface cracks, and loose foreign materials. The applicant documented and tracked inspection findings using the Corrective Action Program, which also detailed the corrective action(s) taken to mitigate the conditions. The applicant established periodic containment concrete IWL inspections in which all accessible external surfaces of the containment buildings are visually inspected every 5 years for the duration of plant operation in accordance with its IWL AMP.

On April 23, 2009, during a Unit 1 IWE inspection, a paint blister was discovered on the containment liner. Further investigation revealed through-wall corrosion of the containment liner. The liner defect was associated with the presence of a piece of wood embedded in the concrete directly behind the liner. In response to this operating experience, by letter dated May 7, 2009, the staff issued RAI B.2.5-1, requesting the applicant explain whether or not the concrete or rebar behind the flaw was degraded. The RAI also asked the applicant to explain how the recent plant-specific operating experience would be incorporated into the ASME Section XI, Subsection IWL AMP.

In its response, dated June 1, 2009, the applicant stated that the exposed concrete was not degraded and no structural rebars were affected. The concrete behind the liner contained a small void associated with the volume of the embedded wood. The applicant explained that some concrete immediately around the wood was removed in order to remove the wood. This concrete void was repaired with grout prior to replacement of the liner section. The response further stated that no enhancement to the AMP was needed and no plant-specific program was required. During the removal of the wood, a section of vertical rebar was encountered, but based on the location and orientation it was determined to be a non-structural member used in forming the rebar skeleton during the original concrete pour.

Based on its review, the staff finds the applicant's response to RAI B.2.3-5 acceptable because it demonstrates that the applicant reviewed the impact of the recent plant-specific operating experience on their IWL Program. The condition of the exposed rebar, as well as existing IWL operating experience, provides reasonable assurance that the existing program will capture aging effects of concrete during the period of extended operation.

The staff's operating experience review concludes that that applicant's administrative controls are effective in detecting age-related degradation and initiating corrective action. The staff did not identify any age related issues not bounded by the industry operating experience. The staff confirmed that the operating experience program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.5, the applicant provided the UFSAR supplement for the ASME Section XI, Subsection IWL Program. The staff reviewed this Section and determines that the information in the UFSAR 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 ASME Section XI, Subsection IWL Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this 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 Bolting Integrity Program

Summary of Technical Information in the Application. In LRA Section B.2.6, the applicant describes the Bolting Integrity Program as consistent with the GALL AMP XI.M18, "Bolting Integrity." This program manages the effects of aging for bolting within the scope of license renewal, through periodic inspections, for indication of loss of preload, cracking, and loss of material due to corrosion.

The applicant stated that program inspections are implemented through other AMPs including: the ASME Section XI, Inservice Inspection, Subsections IWB, IWC, & IWD Program; the ASME Section XI, Subsection IWE Program; the ASME Section XI, Subsection IWF Program; the Structures Monitoring Program; and the External Surfaces Monitoring Program.

Staff Evaluation. In the LRA, the applicant stated that the Bolting Integrity Program is an existing program that is consistent with GALL AMP XI.M18.

During its audit, the staff reviewed the applicant's onsite documentation to support its conclusion that the program elements are consistent with the elements in the GALL Report. The staff interviewed the applicant's technical staff and reviewed onsite documents.

In comparing the 10 program elements in the applicant's program to GALL AMP XI.M18, the staff found that the GALL Report "monitoring and trending" program element, requiring that the leak rate be monitored on a defined schedule, was not properly documented in the applicant's bolting integrity program.

In RAI B.2.6-2, dated March 26, 2008, the staff requested that the applicant provide additional information on its leak rate monitoring schedule.

In its response to RAI B.2.6.-2, dated April 25, 2008, the applicant stated that leaks related to bolting, not covered by ASME Section XI, are monitored and corrected using the FENOC Corrective Action Program. The applicant further stated that it relies upon this corrective action program to determine the inspection frequency and required response in order to adequately address the leak. However, the staff noted that the FENOC Corrective Action Program has no specific requirements, checks, or limiting processes which would ensure that the inspection frequency does not decrease to less than the biweekly recommendation in the GALL Report. Therefore, the staff determined that the applicant did not provide sufficient information to address the concerns raised in the staff's RAI B.2.6-2, and finds that the program is not consistent with the GALL Report "monitoring and trending" program element. The staff further determined that, pursuant to the guidance in SRP-LR Section 3.1.2.1, this inconsistency shall be documented as a staff-identified difference.

As described above, the staff noted a difference in the Bolting Integrity Program that the applicant should have identified as an exception to the GALL AMP XI.M18. Additionally, the staff determined that although the applicant provides some justification for the difference in this monitoring and trending program element, the justification is not sufficient to justify the inclusion of this staff-identified difference. During a teleconference on September 26, 2008, the applicant agreed to submit a supplement to the original RAI response to further address the issues raised by the staff.

By letter dated October 10, 2008, the applicant provided additional justification for the staff-identified difference resulting from its previous response to RAI B.2.6-2. The applicant stated that although it has no specific written guidance that requires daily monitoring of identified leaks in non-ASME bolted connections, leaks are managed by one of several plant programs, each of which classifies and assesses the significance of the leakage. The applicant also stated that in addition to the FENOC Corrective Action Program which manages leaks that are classified as being "conditions adverse to quality" through periodic monitoring and trending, it also utilizes the Leak Elimination Program. The applicant identifies daily rounds and walk-downs performed by operators, maintenance, and system engineers as contributing to the identification and monitoring of leaks.

Additionally, the applicant stated that leak repair prioritization is determined through the Work Management Process for Units 1 and 2, in accordance with Institute for Nuclear Power Operations (INPO) AP-928, “Work Management Process Description,” which prioritizes leak repairs based on work classification and significance (*i.e.*, system and operational significance). Furthermore, the applicant stated that the Leak Elimination Program for Units 1 and 2, performs monitoring and trending to ensure that leaks which are not considered a “condition adverse to quality” do not challenge system or component functions.

The staff reviewed the applicant’s supplement to its original response to RAI B.2.6-2, and determines that proper plant programs are in place that address leakage of non-ASME bolted connections through the implementation of monitoring, trending, classification, and prioritization processes. The clarification helped the staff determine that the applicant’s leakage monitoring for non-ASME bolted connections demonstrates proper management of leakage through robust plant programs which meet the intent of the GALL Report “monitoring and trending” program element. Based on its review, the staff finds the applicant’s response to RAI B.2.6-2 acceptable and this staff-identified difference to be acceptable. Therefore, the staff’s concern described in RAI B.2.6-2 is resolved.

In the LRA, the applicant stated that loss of preload is not an AERM. The staff requested that the applicant justify its position in not managing the aging effect for loss of preload in RAI B.2.6-3, by letter dated May 8, 2008.

By letter dated June 9, 2008, the applicant responded to RAI B.2.6-3, stating that it manages loss of preload through leakage monitoring and proper installation and maintenance of the components, since the loss of preload in a mechanical joint can result in leakage. The applicant references Electric Power Research Institute (EPRI) Report 10106039 which offers guidance on loss of preload for bolted closures. The guidance states that loss of preload in a mechanical joint does not result in failure of that joint. It can only result in limited leakage that does not impact the pressure boundary to the extent that the intended function is not accomplished. In addition, by letter dated August 22, 2008, the applicant provided clarification that its Bolting Integrity Program addresses all bolting. With this change, the applicant’s management of loss of preload due to thermal effects, gasket creep and self loosening of steel closure bolting, will be consistent with the GALL Report and therefore is acceptable to the staff.

The staff also found that although the applicant claimed that its Bolting Integrity Program was consistent with the GALL AMP, an exception to the GALL Report “parameters monitored/inspected” program element exists in the applicant’s claim of crack monitoring of high strength bolts (actual yield strength ≥ 150 ksi) used in nuclear steam supply system (NSSS) component supports.

In RAI B.2.6-1, dated March 26, 2008, the staff requested that the applicant provide additional information on its use of high strength bolts.

In its response to RAI B.2.6-1, dated April 25, 2008, the applicant stated that the technical basis for this issue is addressed in the “detection of aging effects” program element evaluation in its Bolting Integrity Program evaluation document. Since the GALL Report “detection of aging effects" program element includes the option of waiving volumetric examination of cracking of high strength bolts if adequate justification is provided, the applicant provided justification in its program evaluation document. The applicant's justification includes an evaluation on the environments at Units 1 and 2 where high-strength structural bolting or threaded fasteners are exposed, and whether stress-corrosion cracking (SCC) is an applicable aging effect for those conditions. Based on these evaluations, the applicant stated that SCC was not identified as an AERM. Based on a review of the applicant's completed evaluation and justification, the staff finds the applicant's response to be acceptable because it is consistent with the recommendations provided in GALL AMP XI.18.

Operating Experience. The staff also reviewed the operating experience reports, including a sample of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The staff did not find any evidence of operating experience not bounded by industry experience. A condition report indicated that in 2002, during a VT-1 visual inspection of reactor coolant pump flange bolts, the condition of a bolt was determined to be unsatisfactory. The specific condition the applicant observed was blistering of the bolt coating in the mid-shank area between the head and threads. The threads were also noted to be lightly rusted, and the bolt was replaced. Upon further staff questioning of the BVPS staff and review of the condition report, it was learned that the applicant performed additional investigation to verify the integrity of the remaining flange bolts. As a result, 3 bolts were replaced in total, and proper corrective actions were demonstrated.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical staff to confirm that the operating experience did not reveal degradations that are not bounded by industry experience. Based on this review, the staff finds (1) that the operating experience for this AMP demonstrates that Bolting Integrity Program is achieving its objective of managing system components and (2) that the applicant is taking appropriate corrective actions through implementation of this program.

The staff confirmed that the operating experience program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.6, the applicant provided the UFSAR supplement for the Bolting Integrity Program. The staff reviewed this Section and determines that the information in the UFSAR 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 Bolting Integrity Program and additional information provided in the applicant's RAI responses, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that effects of aging on (a) safety-related bolting, (b) bolting for NSSS component supports, (c) bolting for other pressure retaining components, including nonsafety-related bolting, and (d) structural bolting (actual measured yield strength ≥ 150 ksi), will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 Boric Acid Corrosion Program

Summary of Technical Information in the Application. In LRA Section B.2.7, the applicant described the existing Boric Acid Corrosion Program as consistent with GALL AMP XI.M10, "Boric Acid Corrosion."

This program manages loss of material due to borated water leakage through periodic visual inspections. The program provides for (a) determination of the principal location of leakage, (b) examination requirements and procedures for locating small leaks, and (c) engineering evaluations and corrective actions.

Staff Evaluation. The staff reviewed the "scope of program," "preventative/mitigative actions," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria" and "operating experience" program elements of the applicant's Boric Acid Corrosion Program against the staff's recommended criteria for these programs provided in the corresponding program elements of GALL AMP XI.M10. The staff performed its review of the "corrective actions," "confirmatory actions," and "administrative controls" program elements as part of the staff's review of the applicant's Quality Assurance Program. The staff's evaluation of the Quality Assurance Program is documented in SER Section 3.0.4.

With regard to the staff's review of the "scope of program" "preventative/mitigative actions," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria" and "operating experience" program elements for the AMP, the staff reviewed those portions of the applicant's Boric Acid Corrosion Program that the applicant claimed consistency with GALL AMP XI.M10 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. Onsite interviews with the applicant's technical staff were also held to confirm these results.

The staff reviewed the applicant's license renewal basis document for the Boric Acid Corrosion Program and confirmed that the program scope includes all components and structures made from aluminum alloy or steel materials (including carbon steels, alloy steels, and cast irons) that may be exposed to leakage of borated water from systems containing borated aqueous solutions. The staff determined that the applicant includes copper alloy components within the scope of the Boric Acid Corrosion Program. The staff finds this acceptable because the applicant conservatively treats copper alloy materials as an additional material type that may be susceptible to wastage induced by leakage from borated water sources. The staff finds that the "scope of program" program element for the applicant's Boric Acid Corrosion Program acceptable because it conforms to the recommended GALL AMP XI.M10 and because the applicant has conservatively included copper alloy components within the scope of the program.

The staff also noted that the applicant's Boric Acid Corrosion Program was established based on the applicant's response to Generic Letter (GL) 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants." The staff finds this to be acceptable because it is in conformance with GALL AMP XI.M10.

The staff also noted that the Boric Acid Corrosion Program includes provisions for engineering evaluations and corrective actions, and that if the applicant detects any evidence of borated water leakage, either by programmatic inspections or by other activities, the leakage is evaluated and resolved using the FENOC Corrective Action Program. The staff also noted that the boric acid leakage inspections are performed, pursuant to the AMP, by qualified boric acid corrosion control inspectors. As part of their training, these inspectors complete a VT-2 general training course and perform the VT-2 visual examinations in accordance with either direct visual examination methods or by remote visual examination techniques. The staff further noted that the FENOC Corrective Action Program requires that the applicant document its results from system walkdowns and VT-2 visual examinations on a Boric Acid Corrosion Control Leakage Inspection Report Form, which is retained on file.

The staff determined that these aspects of the applicant's program were consistent with the recommended criteria provided in the program elements of GALL AMP XI.M10. Based on this review, the staff concludes that, in addition to the "scope of program" program element, the remaining program elements for the Boric Acid Corrosion Program are acceptable because they are consistent with the staff's corresponding program element criteria recommended in GALL AMP XI.M10.

Operating Experience. The staff reviewed the operating experience provided by the applicant in the LRA and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff also confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report.

The staff also reviewed the "operating experience" discussion in the applicant's license renewal basis document for the Boric Acid Corrosion Program. The staff reviewed a sample of the condition reports and confirmed that the applicant has identified boric acid corrosion and has implemented appropriate corrective actions.

The applicant stated that the program is periodically evaluated and enhanced to include industry experience. The Boric Acid Program at BVPS was enhanced to include recommendations of the Westinghouse Owner's Group, EPRI guidelines, NRC Bulletins 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," and 2003-02, "Leakage from Reactor Coolant Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity."

The staff reviewed the applicant's responses to NRC Order EA-03-009, as amended in the applicant's response to First Order EA-03-009 (henceforth the Order as Amended); NRC Bulletin 2003-02, "Leakage from Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity," and NRC Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials used in the Fabrication of Pressurizer Penetrations and Steam Piping Connections at Pressurized-Water Reactors," to assess the relevancy of borated water leakage events associated with through-wall cracking in ASME Code Class 1 nickel-alloy locations. The staff evaluated whether those steel components, aluminum alloy components, or copper alloy components in the vicinity of ASME Code Class 1 nickel-alloy locations in the upper reactor vessel (RV) closure head, RV bottom head, and pressurizer system are within the scope of the visual examinations and system walkdowns performed under the applicant's Boric Acid Corrosion Control Program. The staff noted that the applicant's commitments for bare metal visual examinations made in response to the Order, as Amended, NRC Bulletin 2003-02, and NRC Bulletin 2004-01, indicated that the applicant would perform bare metal visual examinations of these component locations; however, it was not clear to the staff whether the inspections in the applicant's responses to these generic communications (including the responses to the Order as Amended) were within the scope of the Boric Acid Corrosion Control Program.

In RAI B.2.7-1, dated May 22, 2008, the staff requested that the applicant clarify the following:

(a) Identify which components are included within the scope of this AMP, and whether the scope includes all Class 1 nickel-alloy locations.

(b) For in-scope nickel-alloy locations (if any), clarify whether the examinations will be implemented through this AMP or some other BVPS AMP in the LRA. If another AMP will be used for specific components, clarify which AMP will be implemented for the examination.

(c) Clarify which programs will be used to evaluate the evidence of leakage that is detected through this AMP or other AMPs.

(d) For the in-scope Class 1 nickel-alloy components, clarify what type of visual examinations (i.e., specify whether VT-1, VT-2 or VT-3, and whether the visual examinations are enhanced, bare-surface, qualified, etc.) will be performed on the components.

In its response to RAI B.2.7-1, dated July 24, 2008, the applicant stated that it does not credit this program for management of cracking in nickel-alloy components, including those in ASME Code Class 1 systems. The applicant stated that, instead, management of cracking in nickel-alloy components, including ASME Code Class 1 nickel-alloy components, is accomplished through implementation of one or more of the following AMPs:

- B.2.2 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
- B.2.9 Closed-Cycle Cooling Water System
- B.2.15 External Surfaces Monitoring
- B.2.22 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components
- B.2.29 Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads
- B.2.30 One-Time Inspection
- B.2.32 Open-Cycle Cooling Water System
- B.2.38 Steam Generator Tube Integrity
- B.2.42 Water Chemistry

Components made from nickel-alloy alloy base metals and nickel-alloy welds are not susceptible to wastage induced by boric acid leakage in the manner that steel components (i.e., carbon steels, alloy steels, or cast irons) or aluminum components are. Thus, the staff noted that the applicant's comment that nickel-alloy components are not within the scope of the Boric

Acid Corrosion Program was valid because it was consistent with this technical basis and with the scoping assessment in the “scope of program” program element in GALL AMP XI.M10. The staff noted however, that leakage from nickel-alloy components potentially could be sources of borated water leakage for steel, copper alloy, or aluminum alloy components within the vicinity of these nickel-alloy components. Thus, the staff was of the opinion that steel, copper alloy, and aluminum alloy components within the vicinity of nickel-alloy components in systems containing borated water inventories must be included within the scope of the applicant’s Boric Acid Corrosion Control Program.

To address this, the staff reviewed the applicant’s Type 2 AMR Tables in the LRA for BVPS to determine whether the applicant does credit the Boric Acid Corrosion Program for management of loss of material due boric acid leakage in the surfaces of steel, aluminum alloy and copper alloy components that are in vicinity of borated systems containing nickel-alloy component locations. The staff verified that the applicant does credit the Boric Acid Corrosion Program to manage loss of material due to boric acid leakage in steel, copper alloy, and aluminum alloy component surfaces that could be potentially exposed to leakage from borated systems, including those in the vicinity of nickel-alloy component locations or nickel-alloy welds. The staff also verified that this includes steel, aluminum alloy, and copper alloy components in the RV, reactor coolant pressure boundary (RCPB) piping, pressurizer, SG, safety injection, residual heat removal (RHR), containment spray, chemical and volume control, boron recovery and primary grade water, area ventilation – other, and building and yard drain systems. Thus, the staff found that the applicant has updated its program to address the impacts of borated water leakage that potentially could occur from through-wall cracking in nickel-alloy components in borated systems and, therefore, as updated the program address relevant operating experience from nickel-alloy component locations. Thus, the staff finds that the applicant’s Boric Acid Corrosion Program has accounted for applicable operating experience associated with borated water leakage, including operating experience associated with borated water leakage that has occurred from nickel-alloy components.

Based on this review, the staff concludes that the applicant has demonstrated that its Boric Acid Corrosion Program is capable of identifying, monitoring, and correcting the effects of boric acid corrosion on the intended function of steel, copper alloy, and aluminum alloy components that may be exposed to borated water leakage, because the staff has verified that the program is consistent with the recommendations in GALL AMP XI.M10 and in SRP-LR Section A.1.2.3.10 and that the program is updated to account for relevant operating experience. Based on this determination, the staff concludes that the Boric Acid Corrosion Program can be expected to ensure that the systems and components within the scope of this program will continue to perform their intended functions consistent with the CLB for the period of extended operation.

<u>UFSAR Supplement</u>. In LRA Section A1.7, the applicant provided the UFSAR supplement for the Boric Acid Corrosion Program. The staff verified that the applicant’s UFSAR supplement summary description for the Boric Acid Corrosion Program conforms to the staff’s recommended UFSAR supplement guidance for these types of programs as found in SRP-LR Table 3.1-2.

Based on this review, the staff finds that UFSAR Supplement Section A.1.7 provides an acceptable UFSAR Supplement summary description of the applicant’s Boric Acid Corrosion Program because it is consistent with the UFSAR Supplement summary description in the SRP-LR for Boric Acid Corrosion Program.

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

3.0.3.1.5 Buried Piping and Tanks Inspection Program

Summary of Technical Information in the Application. In LRA Section B.2.8, the applicant described the new Buried Piping and Tanks Inspection Program as consistent with GALL AMP XI.M34, "Buried Piping and Tanks Inspection Program." The applicant submitted Amendment No. 23 dated September 8, 2008, in which the applicant identified an exception to several of the program elements for this program. The exception is evaluated in the staff evaluation. The applicant stated that this program includes preventive measures to mitigate corrosion and periodic inspections to monitor buried piping conditions for buried carbon steel and stainless steel piping.

Staff Evaluation. In the LRA, the applicant stated that the Buried Piping and Tanks Inspection Program is a new program that is consistent with GALL AMP XI.M34, "Buried Piping and Tanks Inspection Program" with exception.

The staff reviewed those portions of the applicants Buried Piping and Tanks Inspection Program for which the applicant claimed consistency with GALL AMP XI.M34 and found they are consistent. On the basis of the review, the staff concludes that the applicant's Buried Piping and Tanks Inspection Program provides assurance that the aging effect either is not occurring, or is occurring at a very slow rate, and does not affect the intended function of the component or structure.

Exception

In Amendment No. 23 to the LRA dated September 8, 2008, the applicant identified an exception to the "preventive actions," "parameters monitored/inspected," and "acceptance criteria" program elements in GALL AMP XI.M34.

> "LRA Section B.2.8, "Buried Piping and Tanks Inspection," requires a revision to incorporate an exception to the NUREG-1801, Section XI.M34 (same title) aging management program. NUREG-1801, Section XI.M34 states that all buried piping is to be wrapped. However, BVPS installed buried stainless steel AL-6XN piping that is not coated or wrapped; the material has excellent corrosion resistance and the manufacturer recommends no coating or wrapping on the piping. Therefore, the Buried Piping and Tanks Inspection Program described in the BVPS LRA should include and exception to the NUREG 1801 program. LRA B.2.8, affected subsections as listed, is revised to read:
>
> - Preventive Actions

The “preventive actions” program element was modified to read (changes in bold), “In accordance with industry practice, coatings and wrapping are used to protect against corrosion by isolating the external surface of the piping from the soil environment, as applicable. Exception is taken to coating and wrapping AL-6XN stainless steel, because it is resistant to corrosion. The program will ensure that the integrity of the coatings and wrappings of buried pipe is maintained where they are used.”

- Parameters Monitored/Inspected

The “parameters monitored/inspected” program element was modified to read (changes in bold), “When the opportunity arises, buried piping and tanks will be visually inspected for corrosion and coating and wrapping integrity. Any evidence of damaged wrapping or coating defects, such as coating perforation, holidays, or other damage, is an indicator of possible corrosion damage to the external surface of the piping and tanks.”

- Acceptance Criteria

The “acceptance criteria” program element was modified to read (changes in bold), “Any coating and wrapping degradations or evidence of corrosion found during inspections of buried piping and tanks will be evaluated, tracked,, and repaired using the Corrective Action Program.”

The staff finds that this exception is acceptable and that coating or wrapping is not required. AL-6XN piping was developed for sea water service; thus, exposure to Ohio River water and soil would not result in corrosion. The staff noted that AL-6XN piping is often used in soils where MIC causes corrosion of carbon steel piping. (J. R. Maurer, “Application of a Six Percent Molybdenum Stainless Alloy for Nuclear Applications,” NACE Corrosion 89 Conference, New Orleans, LA, National Association of Corrosion Engineers, Paper No. 501, 1989.)

The staff finds the applicant’s Buried Piping and Tanks Inspection Program acceptable because it conforms to the recommended GALL AMP XI.M34 with staff approved exception.

<u>Operating Experience</u>. The staff also audited the operating experience, including a sample of condition reports, and interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. In the LRA, the applicant stated that there is no operating experience that demonstrates the effectiveness of this program because it is a new program.
In order to complete its audit, the staff required additional information on the applicant’s operating experience with buried piping and tanks at BVPS Units 1 and 2.

In RAI B.2.8-1, dated April 3, 2008, the staff requested that the applicant provide information on any major replacements of buried piping at Beaver Valley Power Station Units 1 and 2.

In its response to RAI B.2.8-1, dated May 5, 2008, the applicant stated that major replacements of buried piping at BVPS have occurred because of corrosion. A 6-inch carbon steel river water line was replaced in 1995 with AL-6XN stainless steel from the 24-inch river water headers to the emergency diesel generators (EDGs). This piping supplies cooling water to both trains of the Unit 1 emergency generators. The cause of corrosion was microbiologically influenced corrosion (MIC). Because the AL-6XN piping is corrosion resistant, coating was not necessary.

The staff finds that this piping replacement is acceptable and that coating is not required. AL-6XN piping was developed for sea water service; thus, exposure to Ohio River water and soil would not result in corrosion. The staff noted that AL-6XN piping is often used in soils or raw water where MIC causes corrosion of carbon steel piping.

The applicant also stated that the east and west cement-lined gray cast-iron fire protection headers from the intake structure to the yard loop were replaced in 2002 with cement-lined ductile iron piping. The gray cast-iron piping experienced graphic corrosion, a form of selective leaching. The applicant stated that this piping is coated with a bituminous coating and wrapped with polyethylene sheet.

The applicant further stated that a 6-inch carbon steel line from the service water system (SWS) supply for Unit 2 and return headers to the control room chillers was replaced in 2002 with AL-6XN stainless steel. This piping supplies cooling water to both trains of the Unit 1 emergency generators and experienced pitting and general corrosion. Because the AL-6XN piping is corrosion resistant, coating it was not necessary.

In RAI B.2.30-1, dated April 30, 2008, the staff requested that the applicant respond to the following staff concerns: (a) explain how the applicant manages the effects of aging beyond the volumetric inspection that is conducted prior to the period of extended operation; (b) describe the types of materials used to construct the aboveground tanks located outside; and (c) discuss the applicant's operating history with aboveground tanks.

In its response to RAI B.2.30-1, dated May 5, 2008, the applicant stated:

> The inspection of the tank bottom prior to entering the period of extended operation is the only part of the AMP assigned to manage the potential for aging of the external bottom surfaces of tanks mounted on concrete foundations at BVPS.
>
> BVPS has five aboveground tanks within the scope of license renewal that are located outside and mounted on concrete foundations. These tanks are summarized in the following table:

Tank name	Material of Construction
Refueling Water Storage Tank	Stainless steel
Refueling Water Storage Tank	Stainless steel
Turbine Plant Demineralized Water Storage Tank	Aluminum
Demineralized Water Storage Tank	Stainless steel
Demineralized Water Storage Tank	Stainless steel

> Each of these tanks includes one or more of the following design or construction features: an oil-sand bed, bitumastic coating, sloped foundations, caulking, and/or sealing fillets. These features are expected to preclude water from the

bottom surfaces of the tanks that could result in aging effects. In the BVPS License Renewal Application, FENOC credits either the External Surfaces Monitoring Program or the Structures Monitoring; Program for managing the aging of the externally observable construction features (sloped foundations, caulking, and sealing fillets). However, since verification of the absence of water on the bottom surfaces of the tanks is impractical, these tanks are evaluated using the environment of "soil" for the external bottom surfaces. "Soil" was determined to approximate the worst conditions that could exist if water were not excluded. Loss of material was identified as a potential aging effect for the bottom surfaces of these tanks if the design and construction features failed to exclude water. The One-Time Inspection Program was assigned to verify that the aging effect is not occurring; should the aging effect be verified to be present, the program triggers additional actions that assure the intended function of the tanks will be maintained during the period of extended operation. No additional program was assigned to manage the external bottom surfaces of the tanks, as the aging effect is expected to be precluded by design and construction features, and the purpose of the One-Time Inspection Program is to verify the absence of such effects.

The same aging management approach was used to address aging of the external bottom surfaces of the enclosure-protected Primary Plant Demineralized Water (Storage) Tanks at both units. The Unit 1 tank is fabricated of steel, and the Unit 2 tank is fabricated of stainless steel. Both tanks are mounted on concrete foundations with design and construction features to preclude the presence of water from the tank bottom surfaces. Additionally, these tanks are located within reinforced concrete structures that provide additional protection from the outside environment. The One-Time Inspection Program is assigned to confirm the absence of aging effects from the external bottom surfaces of these tanks.

The NUREG-1801, Section XI.M29, "Aboveground Steel Tanks" program specifically addresses steel tanks, with an emphasis on coating inspection in elements 1 through 6. The XI.M29 program also recommends thickness measurements of inaccessible locations, such as tank bottoms. Since most elements of the XI.M29 program deal with coatings, and would not be applicable to stainless steel and aluminum tanks, thickness measurements of the bottoms of tanks mounted on concrete foundations was incorporated into the One-Time Inspection program, and the program was credited for managing the aging of all in-scope tanks mounted on concrete foundations.

A review of operating experience associated with tank bottoms identified six instances in which the actual or potential for tank bottom degradation was documented and evaluated. Five of these instances either involved fuel oil or lubricating oil tanks, and none of the instances involved external bottom surfaces. A review of the applicant's operating experience did not identify any instances of degradation of the tank bottoms.

The staff finds the applicant's response to RAI B.2.301-1, dated May 5, 2008, acceptable because the applicant has verified that the above ground tanks are not constructed from carbon steel. The staff confirms that stainless steel and aluminum tanks do not require coating of the external surfaces, which is, as the applicant points out, a major part of the Aboveground Tanks Program. Both the Aboveground Tanks Program and the One-Time Inspection Program require a one-time inspection of the tank bottoms, and because the external coatings are not an issue for these tanks, the staff finds that One-Time Inspection Program for checking tank bottoms is acceptable. Therefore, the staff's concerns described in RAI B.2.30-1 are resolved.

The staff confirmed that the operating experience program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.8, the applicant provided the UFSAR supplement for the Buried Piping and Tanks Inspection Program. The staff reviewed this Section and determines that the information in the UFSAR 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 Buried Piping and Tanks Inspection Program and additional information provided in the applicant's RAI responses, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds 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 Program

Summary of Technical Information in the Application. In LRA Section B.2.11, the applicant described the new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program."

The applicant stated that this program will provide reasonable assurance that intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation and moisture can be maintained consistent with the CLB through the period of extended operation. The program will be implemented prior to the period of extended operation.

Staff Evaluation. The staff reviewed the LRA and the onsite bases documents related to the applicant's Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, in which the applicant claims consistency with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program." The staff reviewed the applicant's program documents and confirmed them to be consistent with GALL AMP XI.E1. The staff also confirms that the plant program contains all of the elements of the referenced GALL program and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff held onsite interviews with the applicant's technical personnel to confirm these results.

Operating Experience. In LRA Section B.2.11, the applicant stated that operating experience reports were not available, because this is a new AMP for which there is no plant-specific program operating experience for program effectiveness.

In RAI B.2.11-1, dated May 22, 2008, the staff requested that the applicant explain material degradation recently observed by the applicant during its implementation of other existing activities that relate to the aging effects to be managed by this program.

In its response to RAI B.2.11-1 dated August 22, 2008, the applicant stated that as a result of the operating experience from Turkey Point Unit 3, it conducted a walk down of the Unit 2 cables in the pressurizer area, during RFO 11 (Spring 2005), to look for visual effects of cable overheating that could cause the jacket and insulation to become brittle. No deficiencies were noted. The applicant further stated that in 2001, it identified severely burned and cracked wiring on an equipment field cable, resulting from excess cable contacting a hot relief valve. The condition was entered into the FENOC Corrective Action Program. The cable condition was evaluated, replaced and secured to prevent a reoccurrence.

The staff finds the applicant’s response acceptable because the aging effects of brittle, burned, and cracked cables due to heat in an adverse localized environment are bound by those identified in GALL AMP XI.E1, and the applicant took appropriate corrective action to address the aging of the equipment field cable.

The staff’s review of operating experience followed the guidance found in SRP-LR Section A.1.2.3.10, which states that in the future, an applicant may be required to commit to providing operating experience for a new program to confirm its effectiveness. In the LRA, the applicant stated that it will evaluate industry and plant-specific operating experience in the development and implementation of this program. As additional operating experience is obtained, the applicant will implement lessons learned. The staff confirms that the “operating experience” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.11, the applicant provided the UFSAR supplement for the Non-EQ Insulated Cables and Connections Program. The staff reviewed this Section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d). The staff also verified that applicant has committed (Commitment No. 4 in UFSAR Supplement Table A.4-1 and Commitment No. 4 in UFSAR Supplement Table A.5-1) to implement its new Non-EQ Insulated Cables and Connections Program.

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 and additional information provided in the applicant’s RAI responses, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 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. In LRA, Section B.2.12, the applicant described 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 AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program." The applicant stated that this program will demonstrate that sensitive instrument cables and connections susceptible to aging effects from exposure to adverse localized environments caused by heat, radiation, and moisture will be adequately managed so that there is reasonable assurance that the cables and connections will perform their intended function. This program will be implemented prior to the period of extended operation.

Staff Evaluation. The staff reviewed the LRA and onsite bases documents related to the applicant's Electrical Cables and Connections Not subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program, in which the applicant claimed consistency with GALL AMP XI.E2.

The staff reviewed the applicant's program documents and confirmed them to be consistent with GALL AMP XI.E2. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff held onsite interviews with the applicant's technical personnel to confirm these results.

Operating Experience. In LRA Section B.2.12, the applicant stated that operating experience reports were not available because this is a new AMP for which there is no plant-specific program operating experience for program effectiveness.

In RAI B.2-1, dated May 22, 2008, the staff requested that the applicant explain material degradation recently observed during its implementation of other existing activities that relate to the aging effects to be managed by this program.

In response to RAI B.2-1, dated August 22, 2008, the applicant stated that during the periodic testing of nuclear instrumentation system detectors and associated field cabling, several connectors were found with a degraded condition. These connectors were repaired or replaced and returned to service. A BVPS engineering change package documents that Amphenol triaxial connectors used on the field cables associated with the Unit 1 neutron detectors become degraded due to radiation, heat and high humidity resulting in system noise. Westinghouse recommended that the connectors be changed to a Westinghouse Crimp-On type, having a greater resistance to neutron radiation. The BVPS engineering change package approved replacement of the subject Amphenol connectors with the Crimp-On type, as a design equivalent change. Currently, the field cables associated with the neutron detectors for Unit 2 employ the Westinghouse Crimp-On type connector.
The staff finds the applicant's response to RAI B.2-1 acceptable because the staff determined that adequate operating experience is given in applicant's response to RAI B.2-1. The staff also finds that the aging effects identified by the applicant are bounded by those in GALL AMP XI.E2. Therefore, the staff's concern described in RAI B.2-1 is resolved.

The staff's review of operating experience followed the guidance found in SRP-LR Section A.1.2.3.10, which states that in the future, an applicant may be required to commit to providing operating experience for a new program to confirm its effectiveness. In the LRA, the applicant states that it will evaluate industry and plant-specific operating experience in the development and implementation of this program. The applicant stated that as additional operating experience is obtained, it will implement lessons learned. The staff confirms that the applicant's "operating experience" program element satisfies the criterion defined in the GALL Report and the guidance found in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.12, the applicant provided the UFSAR supplement for the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuit Program. The staff reviewed this Section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d). The staff also verified that applicant has committed (Commitment No. 5 in UFSAR Supplement Table A.4-1 and Commitment No. 5 in UFSAR Supplement Table A.5-1) to implement its new Electrical Cables and Connections Not subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program.

Conclusion. Based on 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 that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report program elements. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 Environmental Qualification (EQ) of Electrical Components Program

Summary of Technical Information in the Application. In LRA, Section B 2.14, the applicant stated that the Environmental Qualification (EQ) of Electrical Components Program manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49 qualification methods. The applicant also stated that the Environmental Qualification (EQ) of Electrical Components Program is an existing program and claimed consistency with GALL AMP X.E1, "Environmental Qualification (EQ) of Electrical Components."

As required by 10 CFR 50.49, environmental qualification program components not qualified for the current license term are refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluations. Aging evaluations for environmental qualification program components are time-limited aging analyses (TLAAs) for license renewal.

Staff Evaluation. The staff reviewed the LRA and onsite bases documents related to the Environmental Qualification (EQ) of Electric Component Program in which the applicant assessed its program consistency with GALL AMP X.E1.

The staff reviewed the applicant's EQ documents and confirmed them to be consistent with GALL AMP X.E1. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff held onsite interviews with the applicant's technical personnel to confirm these results.

In LRA Section 4.4, the applicant indicated that the aging effects of the EQ of electrical equipment identified as TLAAs will be managed during the period of extended operation under 10 CFR 54.21(c)(iii). However, the applicant failed to provide information in its program description and UFSAR supplement regarding the reanalysis attribute to extend the qualified life of EQ components. The staff noted that the important attributes for the reanalysis of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met).

In RAI B.2.14-1, dated May 15, 2008, the staff requested that the applicant provide this information in the program description of the EQ program and UFSAR supplement or provide a technical justification as to why inclusion of this information is not necessary.

In its response to RAI B.2.14-1, dated June 17, 2008, the applicant stated that the program description in LRA Section B.2.14, "Environmental Qualification (EQ) of Electrical Component Program," are revised to include the EQ component reanalysis attributes as described in GALL AMP X.E1. The applicant further stated that additional details regarding the EQ component reanalysis attributes are added to the LRA Section B.2.14 Program Description and is revised to now read:

> B.2.14 Environmental Qualification (EQ) of Electrical Components
>
> The Environmental Qualification (EQ) of Electrical Components Program manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49 qualification methods. As required by 10 CFR 50.49, environmental qualification program components not qualified for the current license term are refurbished, replaced, or their qualification extended prior to reaching the aging limits established in the evaluation. Aging evaluation for environmental qualification program components are TLAAs for license renewal.
>
> EQ Component Reanalysis Attributes: The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of the BVPS EQ program. While a component life-limiting condition may be due to thermal, radiation or cyclical aging, the vast majority of component aging limits are based on thermal conditions.
>
> Conservatism may exist in aging evaluation parameters, such as the assumed ambient temperature of the component, an unrealistically low activation energy, or in the application of a component (de-energized versus energized).The reanalysis of an aging evaluation is documented according to BVPS quality assurance program requirements, which require the verification of assumptions

and conclusions. Important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met).These attributes are discussed in the following four subsections.

Analytical Methods: The analytical models used in the reanalysis of an aging evaluation are the same as those previously applied during the original evaluation. The Arrhenius methodology is an acceptable model for a thermal aging evaluation. For license renewal radiation aging evaluation, 60-year normal radiation dose is established by extrapolating the 40-year normal dose (40-year dose X 1.5) plus accident radiation dose. 60-year cyclical aging is established in a similar manner. Other models may be justified on a case-by case basis.

Data Collection and Reduction Methods: Reducing excess conservatism in the component service conditions (for example, temperature, radiation, and cycles) used in the prior aging evaluation is the chief method used for a reanalysis. Actual monitored service conditions, such as temperature, are typically lower than the design service conditions used in the prior aging, evaluation and, therefore, can support extended thermal life of the equipment.

Underlying Assumptions: EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. 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. Excess conservatism in thermal life analysis may be reduced by reevaluating material activation energy, to justify a higher value that would support extended life at elevated temperature. Similar methods of reducing excess conservatism in the component service conditions and material properties used in prior aging evaluations may be used for radiation and cyclical aging. Any changes to material activation energy will be justified.

Acceptance Criteria and Corrective Actions: If qualification cannot be extended by reanalysis, the component is refurbished or replaced prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner (that is, sufficient time is available to refurbish, replace or requalify the component if reanalysis is unsuccessful).

The Environmental Qualification (EQ) of Electric Components Program is an existing program established to meet BVPS commitments for 10 CFR 50.49. It is consistent with NUREG-1801, Section X.EI, "Environmental Qualification (EQ) of Electric Components." This 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 function(s) during accident conditions after experiencing the effects of inservice aging.

Based on its review, the staff finds the applicant's response to RAI B.2.14-1 acceptable because the applicant has amended the LRA such that the Environmental Qualification (EQ) of Electric Components Program now contains the reanalysis attributes. These attributes are consistent with those described in GALL AMP X.E1. Therefore, the staff's concern described in RAI B.2.14-1 is resolved.

The applicant stated in its basis documents that the Detection of Aging Affects and Monitoring and Trending program sub-element is consistent with that of GALL AMP X.E1 and was addressed in basis document references. However, the staff reviewed these references and found that they did not specifically address monitoring or inspection of certain environments to ensure that a component is within the bounds of its qualification basis, or as a means to modify the qualified life.

In RAI B.2.14-2, dated May 15, 2008, the staff requested that the applicant address how it performs or inspects certain environments to ensure that a component is within the bounds of its qualification basis or a means to modify the qualified life during the extended period of operation. The staff also requested the applicant revise the plant procedure to address this element.

In its response to RAI B.2.14-2, dated June 17, 2008, the applicant stated that 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants," and GALL AMP X.E1, do not require detection, monitoring or trending of aging effects of in-service components. GALL AMP X.E1, elements 4 and 5 state:

4. Detection of Aging Effects: 10 CFR 50.49 does not require the detection of aging effects for in-service components. Monitoring or inspection of certain environmental conditions or component parameters may be used to ensure that the component is within the bounds of its qualification basis, or as a means to modify the qualified life.

5. Monitoring and Trending: 10 CFR 50.49 does not require monitoring and trending of component condition or performance parameters of in-service components to manage the effects of aging. EQ program actions that could be viewed as monitoring include monitoring how long qualified components have been installed. Monitoring or inspection of certain environmental, condition, or component parameters may be used to ensure that a component is within the bounds of its qualification basis, or as a means to modify the qualification.

The applicant also stated that while the BVPS Environmental Qualification (EQ) of Electrical Components Program does not require monitoring and trending of component condition or performance parameters of in-service components to manage the effects of aging, the program procedure does provide for inspections and monitoring activities, which are acceptable bases to ensure that the component is within the bounds of its qualification basis or to modify the qualified life through reanalysis. Specifically the EQ Program procedure requires that:

- The EQ Engineer determine the established qualified life values by developing and verifying an aging analysis for establishing the replacement cycle for electrical equipment and/or associated parts.

- Based on the results of the aging analysis, the EQ Engineer designate the equipment and part service life values that shall be utilized in determining the replacement period.

- The EQ Engineer prepare a Maintenance Assessment Package identifying specific maintenance requirements to preserve qualification, replacement intervals based on verified qualified life values, and any interface requirements, and maintenance surveillances (such as temperature or radiation monitoring) necessary to monitor certain equipment parts that are likely to experience age-related degradation.

- FENOC implement the maintenance surveillances necessary to monitor certain equipment parts that are likely to experience age-related degradation.

The applicant further stated that the BVPS EQ procedure is compliant with the requirements of 10 CFR 50.49. GALL AMP X.E1 program sub-elements do not require monitoring or inspecting certain environments to ensure that a component is within the bounds of its qualification basis, or as a means to modify the qualified life. Therefore, no changes are required for the BVPS EQ program.

Because GALL AMP X.E1 program elements do not require monitoring and trending of component condition or performance parameters of in-service components to manage the effects of aging, the staff determines that the BVPS Environmental Qualification (EQ) of Electrical Components Program, which is consistent with GALL X.E1, are not required to be changed. The staff concludes that the applicant's implementation procedures provide for inspections and monitoring activities to ensure that the component is within the bounds of its qualified life and that this procedure is in compliance with 10 CFR 50.49. Therefore, the staff finds the applicant's response acceptable.

Operating Experience. The staff reviewed the applicant's operating experience reports, including a sample of condition reports, and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the industry experience. The applicant performed a self-assessment in 2006 based upon industry operating experience that identified discrepancies in the information contained within the applicant's preventive maintenance database and the associated EQ program documentation. The self-assessment found that one of the 94 EQ Maintenance Assessment Packages in the preventive maintenance database was deficient and would have caused installation of equipment beyond its qualified life value. A corrective action program report was generated to correct the frequency of replacement from 22 years to 20 years.

The staff finds that the applicant's operating experience identified above and those identified in program basis documents, demonstrate that the identification of program weakness and timely corrective actions as part of the applicant's EQ program, provide assurance that program will remain effective in maintaining equipment within its qualified basis and qualified life.

The staff confirms that the "operating experience" program element satisfies the criterion defined in GALL Report and the guidance found in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.14, the applicant provided the UFSAR supplement for the Environmental Qualification (EQ) of Electric Components Program. The staff reviewed this Section and identified areas in which additional information was necessary to determine whether an adequate summary description of the applicant's program was consistent with the SRP-LR. The staff noted that, in comparing the UFSAR supplement with SPR-LR, Table 4.4-2, "Examples of FSAR Supplement for Electrical Qualification of Electric Equipment TLAA Evaluation," the applicant did not address the reanalysis attributes.

In RAI B.2.14-1, dated May 15, 2008, the staff requested that the applicant provide this information in the FSAR supplement.

In its response to RAI B.2.14-1, dated June 17, 2008, the applicant stated that LRA Section A.1.14 does not provide sufficient details regarding the "EQ Component Reanalysis Attributes" as described in GALL AMP X.E1. The applicant provided the additional details and revised the LRA Section A.1.14 Program Description to read:

> A.1.14 Environmental Qualification (EQ) of Electrical Components Program
>
> The Environmental Qualification (EQ) of Electrical Components Program manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49 qualification methods. As required by 10 CFR 50.49, environmental qualification program components not qualified for the current license term are refurbished, replaced, or their qualification extended prior to reaching the aging limits established in the evaluation. Aging evaluation for environmental qualification program components are TLAAs for license renewal.
>
> EQ Component Reanalysis Attributes: The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of the BVPS EQ program. While a component life-limiting condition may be due to thermal, radiation or cyclical aging, the vast majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters, such as the assumed ambient temperature of the component, an unrealistically low activation energy, or in the application of a component (de-energized versus energized). The reanalysis of an aging evaluation is documented according to BVPS quality assurance program requirements, which require the verification of assumptions and conclusions. Important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed in the following four subsections.

Analytical Methods: The analytical models used in the reanalysis of an aging evaluation are the same as those previously applied during the original evaluation. The Arrhenius methodology is an acceptable model for a thermal aging evaluation. For license renewal radiation aging evaluation, 60-year normal radiation dose is established by extrapolating the 40-year normal dose (40-year dose X 1.5) plus accident radiation dose. 60-year cyclical aging is established in a similar manner. Other models may be justified on a case-by case basis.

Data Collection and Reduction Methods: Reducing excess conservatism in the component service conditions (for example, temperature, radiation, and cycles) used in the prior aging evaluation is the chief method used for a reanalysis. Actual monitored service conditions, such as temperature, are typically lower than the design service conditions used in the prior aging, evaluation and, therefore, can support extended thermal life of the equipment.

Underlying Assumptions: EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. 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. Excess conservatism in thermal life analysis may be reduced by reevaluating material activation energy, to justify a higher value that would support extended life at elevated temperature. Similar methods of reducing excess conservatism in the component service conditions and material properties used in prior aging evaluations may be used for radiation and cyclical aging. Any changes to material activation energy will be justified.

Acceptance Criteria and Corrective Actions: If qualification cannot be extended by reanalysis, the component is refurbished or replaced prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner (that is, sufficient time is available to refurbish, replace or re-qualify the component if reanalysis is unsuccessful).

The Environmental Qualification (EQ) of Electric Components Program is an existing program established to meet BVPS commitments for 10 CFR 50.49. It is consistent with NUREG-1801, Section X.EI, "Environmental Qualification (EQ) of Electric Components." This 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 function(s) during accident conditions after experiencing the effects of inservice aging.

Based on its review, the staff finds the applicant’s response to RAI B.2.14-1acceptable because the applicant has provided additional details regarding the EQ component reanalysis attributes and has revised the LRA Section A.1.14 Program Description to now contain the reanalysis attributes. The staff finds the applicant’s response acceptable. With the UFSAR supplement described above, the staff finds that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. Based on its review, the staff finds the applicant's Environmental Qualification (EQ) of Electrical Component Program acceptable because it is consistent with the GALL Report and the plant is bounded by the conditions set forth in the GALL Report for this AMP. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement and the amendments as described above 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 External Surfaces Monitoring Program

Summary of Technical Information in the Application. In LRA Section B.2.15, the applicant described the new External Surface Monitoring Program, and claimed consistency with GALL AMP XI.M36, "External Surface Monitoring." The applicant stated that the program will consist of periodic inspections to monitor the external surfaces of in-scope steel components and other metal components for material degradation and leakage, and periodic inspection of in-scope elastomer components for hardening, loss of strength or cracking through physical manipulation. The program will also manage reduction of heat transfer of radiator fins.

Staff Evaluation. The staff reviewed those portions of the applicant's External Surface Monitoring Program that the applicant claimed consistency with GALL AMP XI.M36 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff held onsite interviews with the applicant's technical personnel to confirm these results.

The staff also reviewed the applicant's license renewal basis document for the External Surface Monitoring Program and confirmed that the program scope includes all those systems for which the applicant credited this program in its AMR results.

The staff finds the applicant's External Surface Monitoring Program acceptable because it conforms to the recommended GALL AMP XI.M36.

GALL AMP XI.M36 is credited for managing the aging effect of loss of material due to general, pitting and crevice corrosion for steel components. However, the applicant expanded the scope to include additional aging effects and materials.

In RAI B.2.15-1, dated May 22, 2008, the staff requested that the applicant justify the following: (a) How this program will manage reduction of heat transfer of ERF diesel generator jacket water radiator fins; (b) How this program will manage hardening, loss of strength and cracking of elastomers; and (c) Why crediting this program for managing loss of material for aluminum, CASS, stainless steel, copper alloy and nickel-alloy material is not considered an exception to the GALL Report.

In its response to RAI B.2.15-1(a and b), dated July 24, 2008, the applicant stated the following:

> Item (a). The applicant stated that the program will require inspection of radiators associated with diesel engines and diesel driven equipment. The radiator fins

are externally visible and can be inspected for build-up of dust, dirt, and debris that could result in a reduction of heat transfer. The applicant also referred to its response to RAI 3.3.2.7-1, provided in its letter dated June 9, 2008. In that RAI, the staff requested that the applicant justify whether tubes are included in this line item for radiator fins. The applicant responded that the LRA Section B.2.15 was revised to state that inspection is required for radiators (fins and tubes) associated with diesel engines and diesel driven equipment for build-up of dust, dirt and debris. The applicant also revised UFSAR Supplement Section A.2.15 to identify both fins and tubes.

The staff reviewed the applicant response and noted that the radiator fins and tubes, which are externally accessible, will be inspected for dust, dirt and debris. Because accumulation of dust, dirt and debris could cause a reduction in heat transfer, inspection and appropriate corrective actions to clean the surfaces would ensure that the aging effects will be appropriately managed. Therefore, the staff finds the applicant's response to RAI B.2.15-1(a) acceptable and concludes that the External Surface Monitoring Program will adequately manage the aging effects of reduction of heat transfer for radiator fins and tubes associated with diesel engines and diesel driven equipment through the period of extended operation.

Item (b). For aging management of elastomers, the applicant referenced its response to RAIs 3.3.2.3-03, 3.4.2.3-3, RAI 3.3.2.2.5.1-1, and 3.4.2.3-1A, provided in its letter dated July 21, 2008. In this response, the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4, such that those components are classified as "short-lived" and not subject to aging management pursuant to 10 CFR 54.21(a)(1)(ii). The remainder of the applicant's response addressed aging management of elastomeric flexible connections in ventilation systems, which are the only remaining elastomeric components subject to aging management.

For elastomeric components in the ventilation systems, the applicant stated that its External Surface Monitoring Program contains increased scope beyond GALL AMP XI.M36 to include aging management of elastomeric flexible connections. The applicant originally did not identify the increased scope of the elastometer nor include an evaluation of the 10 program elements related to the increased scope in the External Surfaces Monitoring Program discussion in LRA Appendix B. Therefore, the applicant provided a 10-element summary of the increased scope that addresses elastomers in its response to RAIs 3.3.2.2.5.1-1 and 3.4.2.3-1A.

In its response, the applicant also summarized how its External Surface Monitoring Program will manage the aging effect of hardening, loss of strength and cracking of elastomeric flexible connections. The applicant stated that physical manipulation of elastomer components, such as by pinching or prodding flexible connections in ventilation systems will be performed, which will aid in identification of elastomer aging effects. The applicant further stated that cracking of elastomer components becomes evident at the outside radius of elastomer deformations as the cracks open, and changes in material properties, such as hardening and loss of strength, can be detected during manipulation of elastomer components by the relative inflexibility of the component, or by the failure of the component to return to its previous shape or configuration. Additionally, the applicant stated that as the external environment of ventilation systems is similar to the internal environment, the condition of the external surface is expected to be representative of the internal surface condition.

The staff reviewed the applicant's RAI responses and the 10 element summary description. On the basis that physical manipulation of elastomeric components will be performed to inspect for cracks, and changes in material properties, the staff finds the applicant response acceptable. Since the GALL AMP XI.M36 does not address elastomeric components, the staff finds that these physical manipulation activities in addition to the visual inspection, will adequately manage the aging effects of cracking, and change in material properties of elastomeric components in ventilation environment through the period of extended operation.

In its response to RAI B.2.15-1(c), dated July 24, 2008, the applicant stated the following:

> Item (c). The applicant responded that loss of material from the external surface of stainless steel (or other metals) will be evident by surface irregularities or localized discoloration before loss of function occurs. Although materials other than steel are not discussed in the GALL Report for this program, identification of the loss of material aging effect for other metals is amenable to the same types of visual inspections.

The staff reviewed the response and concurs that pitting and crevice corrosion will show similar characteristics for stainless steel, copper alloy or aluminum as it shows for steel. In that regard, all metallic components would corrode similarly and visual inspection will detect age related degradation. Based on its review, the staff finds the applicant's response acceptable and concludes that the External Surface Monitoring Program will adequately manage the aging effects of loss of material on external surfaces of all metallic components through the period of extended operation.

During the regional inspection in June and July 2008, the staff requested additional information from the applicant for "detection of aging effects" program element to clarify what is meant by the term "not readily accessible," and to incorporate examples of those inaccessible areas and when and how external surfaces of equipment in those areas will be inspected.

In its letter dated September 8, 2008, the applicant stated:

> Component surfaces in areas that are not readily accessible during plant operations and refueling outages will be inspected at such intervals that will provide reasonable assurance that the effects of aging will be managed such that applicable components will perform their intended function during the period of extended operation. Examples of areas that are not readily accessible are Intake Structure (and Auxiliary Intake Structure) bays and River Water Service Water Valve Pits. Valve pits are located adjacent to the southern end of the Intake Structure, adjacent to the northern end of the Unit 2 Safeguards Area, and in the yard areas where the Auxiliary River Water system connects to the River Water system. These areas are accessible for inspections during specific activities such as bay cleaning, maintenance, clearance operations, or valve stroke tests. Areas such as pipe trenches are to be inspected when the areas are made accessible for maintenance or other reasons. If only partial inspections are possible for an area such as a pipe trench, the extent of condition of any

> deficiencies identified are to be evaluated to provide assurance that any remaining inaccessible components (such as within pipe trenches) will remain capable of performing their intended functions, or the remaining portion of the normally inaccessible areas are to be exposed for inspection.

The staff reviewed the applicant response and noted that the applicant has identified the areas that are not readily accessible, and defined how and when the inspections will be performed. On the basis that these inaccessible areas will be inspected during cleaning, maintenance or performance testing, and that results of any partial inspection will be evaluated and results applied to the remainder of the inaccessible area, the staff finds the applicant response acceptable and considers the issue closed.

Operating Experience. The staff reviewed the applicant's operating experience and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. In the LRA, the applicant stated that there is no operating experience with the effectiveness of the program because it is a new program. The staff issued a generic RAI B.2-1, Part 1 by letter dated May 22, 2008, requesting the applicant to discuss recent observed material degradation during the implementation of other existing activities that relate to the aging effects that will be managed by the new program and provide the results in the "operating experience" element for that new program. Additionally, in RAI B.2-1, Part 2, as stated in SRP-LR, Appendix A.1.2.3.10.2, the applicant was requested to include a commitment to provide operating experience in the future for new programs to confirm their effectiveness.

In its letter dated August 22, 2008, in response to RAI B.2-1, Part 1, the applicant responded that corrosion of external surfaces has been reported in the course of performing surveillance tests, preventive maintenance programs, and system walk-downs at BVPS. The applicant stated that in 2006, a walkdown of the BVPS Service Water System identified a very small leak in the Service Water one-inch diameter piping. The applicant further stated that the leakage rate was estimated to be less than one drip per minute, with no spray that could impact other equipment, and a condition report was written and corrective action taken to repair the pipe.

In its letter dated August 22, 2008, in response to Part 2, the applicant amended the LRA to include a new Commitment No. 29 in Table A4.1 for Unit 1 and Commitment No. 28 in Table A5.1 for Unit 2, to perform a program self-assessment of all new license renewal aging management programs, to be completed five (5) years after entering the period of extended operation.

On the basis that the applicant ha identified an example of plant operating experience observed during the performance of system walkdown, the staff finds the response acceptable and considers the issue in RAI B.2-1, Part 1 closed. On the basis that the applicant has amended the LRA to include a new commitment to confirm the effectiveness of the new license renewal aging management programs based on the incorporation of operating experience, the staff finds the response acceptable and considers the issue in B.2-1, Part 2 closed.

The staff confirms that the "operating experience" program element satisfies the criterion defined in GALL Report and the guidance found in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A1.15, the applicant provided the UFSAR supplement for the External Surface Monitoring Program. The staff verified that the UFSAR supplement summary description for the External Surface Monitoring Program conforms to the guidance found in SRP-LR Table 3.2-2. The staff also verified that the applicant has committed (Commitment Nos. 6 and 7) to implement its new External Surfaces Monitoring Program in UFSAR Supplement Tables A.4-1 and A.5.1, respectively.

Based on this review, the staff finds that FSAR Supplement Section A.1.15 provides an acceptable FSAR Supplement summary description of the applicant's External Surfaces Monitoring Program because it is consistent with the FSAR Supplement summary description for External Surfaces Monitoring Program, as required by 10 CFR 54.21(d).

Conclusion. Based on its review, the staff finds the applicant's External Surface Monitoring Program acceptable because it is consistent with the GALL Report and the plant is bounded by the conditions set forth in the GALL Report for this AMP. The staff also finds that the applicant's External Surface Monitoring Program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.10 Flow-Accelerated Corrosion Program

Summary of Technical Information in the Application. In LRA Section B.2.18, the applicant described the existing Flow Accelerated Corrosion Program and claimed consistency with GALL AMP XI.M17, "Flow-Accelerated Corrosion."

The applicant stated that this program is based on EPRI guidelines in Nuclear Safety Analysis Center-202L-R2, "Recommendations for an Effective Flow Accelerated Corrosion Program." The program includes analyses to determine critical locations. The applicant performs initial inspections to determine the extent of thinning, using ultrasonic or other approved inspection techniques and follow-up inspections to confirm the predictions.

Staff Evaluation. The staff reviewed those portions of the applicant's Flow-Accelerated Corrosion Program that the applicant claimed consistency with GALL AMP XI.M17 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff held onsite interviews with the applicant's technical personnel to confirm these results.

The staff reviewed the applicant's license renewal basis documents for the Flow-Accelerated Corrosion Program and confirmed that the program's scope includes the systems and components that could be affected by flow-accelerated corrosion (FAC). The staff finds the applicant's Flow-Accelerated Corrosion Program acceptable because it conforms to the recommended GALL AMP XI.M17.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff also confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report.

Operating Experience. The staff also reviewed the applicant's "operating experience" discussion provided in the applicant's license renewal basis document for the Flow-Accelerated Corrosion Program. Additionally, the staff reviewed a sample of condition reports and confirmed that the applicant has identified FAC and has implemented appropriate corrective actions. The staff noted that in the last outages for Units 1 (1R17), February-April 2006 and Unit 2 (2R12), October-November 2006, the applicant inspected over 70 locations per unit and performed fifteen additional examinations per unit as expanded scope. The staff also noted that the applicant schedules and implements replacements of those steel components that are determined to have an unacceptable amount of FAC-induced corrosion or whose rate of corrosion predicts that the components will be unacceptable for service prior to reaching the next scheduled inspection outage (usually scheduled RFOs). The staff reviewed the results of the outages from Units 1 and 2 and confirms that the applicant has implemented appropriate corrective actions.

The staff verified that the applicant has evaluated the relevant pressurized-water reactor (PWR) operating experience identified in NRC Bulletins, GLs, and Information notices listed in the Reference Section of GALL AMP XI.17, for their relevance to the Flow-Accelerated Corrosion Program. The applicant has used this information or has performed an engineering evaluation to justify that the relevant operating experience is not applicable to the plant designs for Units 1 and 2; or, has used the operating experience as the basis for including components evaluated in the generic communications in its Flow-Accelerated Corrosion Program. Thus, based on this review, the staff concludes that the applicant's program incorporates relevant operating experience on FAC identified in applicable NRC generic communications.

Thus, based on this review, the staff has confirmed that the applicant has addressed the relevant operating experience that is applicable to the applicant's Flow-Accelerated Corrosion Program, and finds that the applicant's Flow-Accelerated Corrosion Program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and correcting the effects of FAC and can be expected to ensure that piping wall thickness will be maintained above the minimum required by design.

UFSAR Supplement. In LRA Section A1.18, the applicant provided the UFSAR supplement for the Flow-Accelerated Corrosion Program. The staff verified that the UFSAR supplement summary description for the applicant's Flow-Accelerated Corrosion Program conforms to the staff's guidance found in SRP-LR Table 3.4-2.

Based on this review, the staff finds that FSAR Supplement Section A.1.18 provides an acceptable FSAR Supplement summary description of the applicant's Flow-Accelerated Corrosion Program because it is consistent with the FSAR Supplement summary description for Flow-Accelerated Corrosion Program found in the SRP-LR.

Conclusion. Based on its review, the staff finds the applicant's Flow-Accelerated Corrosion Program acceptable because it is consistent with the GALL Report and the plant is bounded by the conditions set forth in the GALL Report for this AMP. The staff also finds that the program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by

10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.11 Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Summary of Technical Information in the Application. In LRA Section B.2.21, the applicant stated that the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program that is consistent with GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirement."

The applicant also stated that the purpose of this AMP will be to demonstrate that inaccessible, non-EQ medium-voltage cables, susceptible to aging effects caused by moisture and voltage stress, will be managed such that there is reasonable assurance that the cables will perform their intended function in accordance with the CLB during the period of extended operation.

Staff Evaluation. The staff reviewed the LRA and onsite bases documents related to the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program in which the applicant claimed consistency with GALL AMP X1.E3.

The staff reviewed the applicant's inaccessible medium-voltage cable documents and confirmed them to be consistent with GALL AMP X1.E3. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and that the conditions at the plant are bounded by the conditions for which the GALL report is evaluated. The staff held onsite interviews with the applicant's technical personnel to confirm these results. Within the Scope of Program element, the staff found that the applicant did not define the elements "significant moisture" and "significant voltage," contrary to GALL AMP XI.E3.

In RAI B.2.21-1, dated May 15, 2008, the staff requested that the applicant define the program elements "significant moisture" and "significant voltage" or provide a technical justification for why the definition is not required.

In its response to RAI B.2.21-1, dated June 17, 2008, the applicant stated that the Scope of Program element of LRA, Section B.2.21, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program" for BVPS, is revised to include the definition of "significant moisture" and "significant voltage," as defined in GALL AMP XI.E3 as follows:

> "Significant moisture" exposure is defined as periodic exposure to moisture that lasts more than a few days (e.g., cable in standing water). Periodic exposure to moisture which lasts less than a few days (i.e., normal rain and drain) is not significant.
>
> "Significant voltage" exposure is defined as being subjected to system voltage for more than twenty-five percent (25%) of the time.

Based on its review, the staff finds the applicant's response to RAI B.2.21-1 acceptable because the applicant amended LRA Section B.2.21 to add definitions for "significant moisture" and significant voltage" that are consistent with GALL AMP XI.E3. Therefore, the staff's concern described in RAI B.2.21-1 is resolved.

Under the program description, GALL AMP XI.E3 identifies NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, EPRI TR-109619, and EPRI TR-103834-P1-2 as the basis for technical information and guidance. However, the applicant did not identify these documents as the basis for its BVPS AMP B.2.21, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program."

In RAI B.2.21-2, dated May 15, 2008, the staff requested that the applicant identify specific documents used as technical information and guidance considered in the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program or provide a justification as to why consideration of the above documents are not necessary.

In response to RAI B.2.21-2, dated June 17, 2008, the applicant stated that the technical information and guidance of NUREG/CR-5643, IEEE Std. 1205, SAND 96-0344, and EPRI TR-109619 were used in developing its "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirement Program as described in LRA Section B.2.21. These documents are listed as cited references in the BVPS Program Evaluation Document for the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Program.

Full Reference Listing :

1. NUREG/CR-5643, "Insights Gained From Aging Research," dated March, 1992.

2. IEEE Standard 1205-2000, "IEEE Guide for Assessing, Monitoring, and Mitigating Aging Effects on Class 1 E Equipment Used in Nuclear Power Generating Stations," Revision of IEEE Std. 1205-2000, March 30, 2000.

3. SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Terminations," September, 1996.

4. EPRI TR-1 09619, "Guideline for the Management of Adverse Localized Equipment Environment," Revision Final, June, 1999.

5. EPRI TR-103834-P1-2, "Effects of Moisture on the Life of Power Plant Cables," Revision Final, August, 1994.

Based on its review, the staff finds the applicant response to RAI B.2.21-2 acceptable because the applicant has confirmed the use of technical information and guidance of the staff and industry guidance documents to develop the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program. The staff notes that the applicant has listed these documents in its program evaluation document. Therefore, the staff's concern described in RAI B.2.21-2 is resolved.

<u>Operating Experience</u>. The staff reviewed the operating experience reports, including a sample of condition reports, and interviewed the applicant's technical staff to confirm that the plant-

specific operating experience did not reveal any degradation not bounded by industry experience. LRA Section B.2.21 states that the inaccessible medium-voltage cables is a new program for which there is not plant-specific operating experience for program effectiveness. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. GALL AMP XI.E3 states that operating experience has shown that cross linked polyethylene or high molecular weight polyethylene insulation materials are most susceptible to water tree formation. The formation and growth of water trees varies directly with operating voltage. Also, minimizing exposure to moisture minimizes the potential for the development of water treeing.

In LRA Section B.2.21, the applicant also states that currently it has a manhole inspection program which identifies and evaluates water collection in the manholes. The applicant further stated that this prevention program has been effective in monitoring and evaluating the exposure of water to cable and cable supports located in manholes. The staff noted during the audit that in Corrective Report 04-03545, the applicant discovered that the Manhole 1EMH-19A Duct 944 had 34 inches of water in it during performance of its manhole inspection for water induced damage in 2004. The water was removed, and the lower cable tray was severely deteriorated to the point where one of the ladder runs of the tray had fallen out and the tray support brackets were also badly rusted. The applicant's manhole inspection was last performed in September 2006. The findings included missing seals, cracked walls, corroded supports, and water intrusion, but no cable damage was found. In reviewing the corrective report, the staff noted that certain manholes had chronic flooding problems. These manholes, numbered 1EMH-8A, 8B, and 15, are located below grade near the intake structure and repeatedly had water levels of 10 to 15 feet. Manholes 1EMH - 8A&8B contain safety-related cables from both Units 1 and 2. Based on the above, the staff was concerned that the applicant's corrective actions and periodic inspection for water collection in the manholes were not adequate.

In RAI B.2.21-3, dated May 15, 2008, the staff requested that the applicant provide a technical justification as to (a) how the applicant's proposed once every two-year water inspection of the manholes is adequate to ensure that the cables are kept from experiencing significant moisture during the period of extended operation; (b) how the applicant adjusts the inspection frequency based on operating experience, and (c) what are the applicant's corrective actions to address submerged cable conditions that exist in certain manholes.

In its response to RAI B.2.21-3, dated June 17, 2008, the applicant stated that Corrective Report 04-03545 identified water in manhole 1EMH-19A Duct 944, and engineering performed an inspection of the cable and tray after the water was removed. Corrective Action 04-03545-1 requires that other manholes be inspected for this condition. Manholes 1EMH-08A&B were inspected and found to have water in them, although the depth of water was not provided. Engineering performed a visual evaluation of the cable conditions and determined that the cables were acceptable. The cable submergence issue had been previously addressed in Corrective Reports 02-02302 and 02-02348.

The applicant further stated that historical operating experience information from 2001, included in the documentation for Corrective Action 04-03545-1, was presented to the NRC Resident Inspector on October 26, 2001. The historical information identified certain manholes with chronic flooding problems. These manholes, numbered 1EMH-8A, 8B, and 15, are located below grade near the intake structure and were repeatedly found to have water levels of 10 to

15 feet. The plant operating experience was used as input to the existing BVPS manhole inspection program. The applicant also stated that the program, as described in LRA Section B.2.21, requires that the applicant take periodic actions, at least once every two years, to prevent cables from being exposed to significant moisture. These include inspecting for water collection in cable manholes and conduit, and draining water, as needed. The applicant further stated this program requirement is consistent with GALL AMP XI.E3, Element 2 and states that the maximum period allowed between inspections is two years. Also, LRA Section B.2.21, under the heading, "Detection of Aging Effects" stated:

> This inspection frequency will be based on actual plant experience with water accumulation in the manhole, with the first inspection to be completed prior to the period of extended operation.

The applicant stated that plant-specific and industry operating experience will be used to identify areas for program improvement, including adjustment of the manhole inspection frequency. Therefore, plant inspection results and industry operating experience will be evaluated to determine if the manhole inspection frequency needs to be adjusted to ensure the cables are not exposed to significant moisture. The applicant further stated that as indicated by the corrective action to Corrective Report 04-03545, indication of water and cable submergence are visually evaluated by engineering using the BVPS Corrective Action Program, and further actions are taken based on the evaluation.

During the regional onsite inspection performed during the week of June 23, 2008, the staff found water in the manholes that contain safety-related cables. The staff determined that these incidents demonstrate that the corrective actions described by the applicant have not been properly implemented, or were not adequate. In light of this operating experience, the staff is concerned that inaccessible medium-voltage cables that have been submerged for a period of time may be degraded and may not perform their intended function during the period of extended operation. The staff finds that the applicant has not used the operating experience for program improvement and enhancement, including adjustment of the manhole inspection frequency and/or using automatic means, if frequent inspection fails to keep the cables dry.

In a letter dated September 8, 2008, the applicant stated that LRA Section B.2.21 requires replacement of the entire section, because the program is being changed from a new program that is consistent with the GALL Report, to a new plant-specific program.

The staff noted that FENOC concluded that that all inaccessible medium-voltage cables within the scope of the new plant-specific program are suitable for operation in a submerged water environment.

The GALL Report does not require inspection and testing of cables that are approved/qualified for submerged environment (*i.e.*, submarine cables). Therefore, the applicant did not identify an AERM for the BVPS cables. However, the staff notes that FENOC has concluded that periodic inspection and testing of submerged medium-voltage cables was conservative to confirm that the aging effects are not occurring, and is revising the program to be plant-specific. Pending the staff's review of cable qualification for submergence (*i.e.*, submarine cables), this issue was identified as open item OI 3.0.3.1.11-1.

During a conference call with the applicant on September 5, 2008, the staff requested that the applicant provide cable procurement and manufacturer test results to demonstrate that the in-scope inaccessible medium-voltage cables connecting the power block to the reactor plant river water pumps and Unit 2 service water pumps, and the emergency response facility feeder were designed for submerged service. In a letter dated October 24, 2008, the applicant provided two reports, "BVS-356, Specification for 5,000 V Power Cable for Beaver Valley Power Station – Unit 1," and "2BVS-309, Specification for Insulated 5,000 V Power Cables (Final Version) for Beaver Valley Power Station – Unit 2."

The staff reviewed the above BVPS documents and determined that an additional request for additional information (RAI) was needed to complete the review. In a letter dated January 5, 2009, the staff issued an RAI requesting additional applicant and/or vendor evaluations to verify that the above cables are designed for submerged applications through the period of extended operation at BVPS Units 1 and 2.

By letter dated March 24, 2009, the applicant amended LRA (Amendment No. 35) and stated that in order to close the staff's open item 3.0.3.1.11-1 of the BVPS Safety Evaluation Report; the applicant would implement the following license renewal commitments prior to entering the period of extended operation:

(1) Adopt an acceptable methodology that demonstrates that the in-scope, continuously submerged, inaccessible, medium-voltage cables will continue to perform their intended function during the period of extended operation, or;

(2) Implement measures to minimize long-term submergence, or;

(3) Replace the in-scope, continuously submerged medium-voltage cables.

The applicant further stated that the above action is intended to complement the AMP identified in BVPS LRA Amendment 23, Section B.2.21, "Inaccessible Medium-Voltage Cables Suitable for Submergence and Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

By letters dated May 14 and May 20, 2009, the applicant amended its LRA (Amendment Nos. 36 and 37) by removing the "suitable for submergence" language from the LRA and revising LRA Section B.2.21 and associated sections to be consistent with GALL AMP XI.E3. In addition, the applicant clarified Commitment 2 by stating that prior to the period of extended operation; it will implement measures to minimize cable exposure to significant moisture. These measures include the dewatering of manholes and the use of dewatering operating experience to adjust the dewatering frequency to minimize cable exposure to significant moisture. Further, the applicant defined significant moisture consistent with GALL AMP XI.E3, which states, "Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant." The applicant also revised Commitment 3 to state that if in-scope, continuously submerged inaccessible medium-voltage cables are replaced; these cables will be designed for submerged environments.

The issue of whether inaccessible medium-voltage cables installed at BVPS and within scope of license renewal are designed for continuous submergence and are in compliance with the current licensing basis is being evaluated by the staff in according with 10 CFR Part 50.

Resolving this issue under 10 CFR Part 50 is consistent with 10 CFR 54.30, “Matters not subject to a renewal ,” which states that, “If the reviews required by 10 CFR 54.21 (a) or (c) show that there is not reasonable assurance during the current license term that licensed activities will be conducted in accordance with the CLB, then the licensee shall take measures under its current license, as appropriate, to ensure that the intended function of those system, structures or components will be maintained in accordance with the CLB throughout the term of its current license.” Requirements incorporated into the current CLB operating term as a result of the staff’s Part 50 evaluation would be carried forward to the period of extended operation.

Based on the above, the staff determines that the implementation of GALL AMP XI.E3 and the above license renewal commitments will address the issue of continuous submergence of inaccessible medium voltage cable at BVPS for the period of extended operation. With LRA Section B.2.21 revised to be consistent with GALL and the implementation of the above commitments (Commitments 11 and 12 as described in Tables A.4-1 and A.5-1 for Unit 1 and Unit 2, respectively), the applicant will be able to demonstrate that the in-scope, continuous submerged, inaccessible medium-voltage cables will perform their intended functions by (1) adopting an acceptable methodology that demonstrates that the in-scope, continuously submerged, inaccessible, medium-voltage cables will continue to perform their intended function during the period of extended operation, or (2) implementing measures to minimize long term inaccessible medium voltage cable submergence, or (3) replacing in-scope continuous submerged inaccessible medium voltage cable with cables designed for submerged service. The staff finds that if the applicant implements Commitment 1 or 3, the aging effect and mechanism due to significant moisture will not be significant for medium voltage cables that are designed for these conditions. If the applicant implements Commitment 2, it will minimize cable exposure to significant moisture and thus minimize the potential for insulation degradation consistent with GALL AMP XI.E3. Consistency with GALL AMP XI.E3 and the applicant’s license renewal commitments will ensure that submerged inaccessible medium-voltage cables will perform their intended functions consistent with the CLB during the period of extended operation. The staff concerns with OI 3.0.3.1.11-1 are resolved.

UFSAR Supplement. The staff reviewed this Section and determines that the information in the FSAR supplement provides an adequate description of the program as required by 10 CFR 54.21(d). The staff also verified that applicant has committed (Commitment No. 11 in UFSAR Supplement Table A.4-1 and Commitment No. 12 in UFSAR Supplement Table A.5-1) to implement its new Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Conclusion. Based on its review, the staff finds that, the applicant’s Inaccessible Medium-Voltage Cable Not Subject to Environmental Qualification Requirements acceptable because it is consistent with the GALL Report program elements and the plant is bounded by the conditions set forth in the GALL Report for this AMP. The staff concludes that, the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.12 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

Summary of Technical Information in the Application. In LRA Section B.2.22, the applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program that is consistent with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components."

The applicant stated that the program will consist of inspections of the internal surfaces of piping, piping components, ducting and other components within the scope of license renewal that are not covered by other AMPs. These internal inspections are performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection.

Staff Evaluation. The staff reviewed those portions of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program that the applicant claimed consistency with GALL AMP XI.M38 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff held onsite interviews with the applicant's technical personnel to confirm these results.

The staff reviewed the applicant's license renewal basis document for the Internal Surfaces in Miscellaneous Piping and Ducting Components Program and confirmed that the program scope includes all those systems for which the applicant credited this program in its AMR results. The staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because it conforms to the recommended GALL AMP XI.M38.

In comparing the elements in the applicant's AMP with GALL AMP XI.M38, the staff found that the "acceptance criteria" element states that the program will inspect for indications of material degradation (*i.e.,* corrosion, cracking, fouling, etc.). However, the applicant did not define the acceptance criteria.

In RAI B.2.22-1, dated May 22, 2008, the staff requested that the applicant define the acceptance criteria.

In its response to RAI B.2.22-1, dated July 24, 2008, the applicant revised LRA Section B.2.22, Acceptance Criteria, and provided details of the acceptance criteria. The applicant stated that for painted or coated surfaces, any evidence of damaged or degraded coating is an indicator of possible corrosion damage to the surface underneath. Therefore, evidence of damaged or degraded coatings is unacceptable and will be evaluated through the FENOC Corrective Action Program. The applicant further stated that any indication of cracking or fouling (*i.e.*, built up dirt, dust, or debris) is unacceptable and will be evaluated using the Corrective Action Program. For materials susceptible to corrosion, significant corrosion is unacceptable. This includes heavy corrosion, localized corrosion, blistered material, pitted material, or visible loss of material due to corrosion. The applicant also stated that a thin, light, and even layer of oxidation can provide protection against further corrosion. It is expected in some systems, and is acceptable.

Based on its review, the staff finds the applicant's response to RAI B.2.22-1 acceptable because that applicant has adequately defined the acceptance criteria and has revised LRA Section B.2.22 accordingly. Therefore, the staff's concern described in RAI B.2.22-1 is resolved.

In LRA Tables 3.3.2-1, 3.3.2-2, 3.3.2-11 and 3.3.2-12, the applicant credited the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the aging effects of cracking and reduction of heat transfer of stainless steel, aluminum, and copper alloy <15% Zn moisture separators and heat exchangers. In LRA Section B.2.22, the applicant stated that this program is consistent with GALL AMP XI.M38. However, the staff noted that GALL AMP XI.M38 is credited for managing the aging effect of loss of material due to corrosion for steel components only.

In RAI 3.3-A, dated September 3, 2008, the staff requested that the applicant justify how the program will manage the aging effect of (a) reduction of heat transfer, or provide a plant-specific program and (b) cracking of moisture separator, or provide a plant-specific program.

In its response to RAI 3.3-A, Part (a), dated October 3, 2008; the applicant responded that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages the aging effect of reduction of heat transfer by performing visual inspection for accumulation of dirt and debris on heat transfer surfaces. The applicant also stated that fouling is specifically included in the GALL AMP XI.M38 in "monitoring and trending" and "acceptance criteria" elements.

The staff reviewed the GALL AMP XI.M38 elements and noted the "monitoring and trending" element states that results of the periodic inspections are monitored for indications of corrosion and fouling; and the "acceptance criteria" element states that indications of fouling that would impact component intended function are reported and will require further evaluation. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspection for accumulation of dirt and debris, and that this program is consistent with the GALL AMP XI.M38, the staff finds the applicant response acceptable. The staff concludes that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will adequately manage the aging effects of reduction of heat transfer of the copper alloy <15% Zn heat exchanger exposed to condensation external environment during the period of extended operation.

In its response to RAI 3.3-A, Part (b), dated October 3, 2008; the applicant stated that the moisture separators potentially susceptible to cracking are associated with Unit 1 emergency diesel generator air start system. The applicant further stated that the determination that cracking is a relevant aging effect for aluminum alloys is dependent upon the presence of zinc or magnesium above the threshold levels in the aluminum alloy. However, levels of zinc and magnesium above these thresholds (greater than 12% zinc and/or 6% magnesium) are not common in aluminum alloys, so the aging effect is not expected to occur. The applicant has amended the LRA to credit the One-Time Inspection Program to confirm the absence of cracking in these moisture separators, instead of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program that it had proposed in the LRA.

On the basis that cracking is not likely to occur in aluminum alloys and the applicant is crediting the One-Time Inspection Program to ensure either aging is not occurring, or aging is so insignificant that an aging management program is not warranted, the staff finds the applicant response acceptable. The staff reviewed the One-Time Inspection Program and documented its evaluation in SER Section 3.0.3.1.17.

Operating Experience. The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff also confirmed that the applicant has reviewed applicable aging effects and industry and plant-specific operating experience and are evaluated in the GALL Report. Furthermore, the staff confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

Although the applicant stated that this is a new program, inspection of internal surfaces during the performance of periodic surveillances and maintenance activities has been in effect at BVPS in support of plant component reliability programs. The staff reviewed a sample of corrective reports and confirmed that the applicant has identified degraded conditions in the internal surfaces during the performance periodic surveillances and has implemented appropriate corrective actions.

The staff finds that the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, with the corrective actions discussed in the LRA, will be effective in identifying, monitoring, and correcting the aging effects and can be expected to ensure that the systems and components within the scope of this program will continue to perform their intended functions consistent with the CLB for the period of extended operation.

UFSAR Supplement. In LRA Section A1.22, the applicant provided the UFSAR supplement for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff verified that the UFSAR Supplement summary description for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program conforms to the staff's recommended UFSAR Supplement guidance provided in SRP-LR Table 3.3-2. The staff also verified that, in LRA Commitment No. 12 of UFSAR Supplement Table A.4-1 and Commitment No. 13 in UFSAR Supplement Table A.5.1, the applicant has committed to implementing its new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

Based on its review, the staff finds that UFSAR Supplement Section A.1.22 provides an acceptable UFSAR Supplement summary description of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program because it is consistent with the UFSAR supplement summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. Based on its review, the staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because it is consistent with the GALL Report and the plant is bounded by the conditions set forth in the GALL Report for this AMP. Based on its review, the staff finds that the applicant's Internal Surfaces in Miscellaneous Piping and Ducting Components Program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds 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. In LRA Section B.2.24, the applicant described the existing Lubricating Oil Analysis Program as consistent with GALL AMP XI.M39, "Lubricating Oil Analysis."
The Lubricating Oil Analysis Program maintains the lubricating oil environment to the required quality for mechanical systems within the scope of license renewal. The program monitors and controls abnormal levels of contaminants *(i.e.*, primarily water and particulates) for lubricating oil system components within the scope of license renewal to preserve an environment not conducive to loss of material, cracking, or reduction of heat transfer. The One-Time Inspection Program will verify the effectiveness of the Lubricating Oil Analysis Program.

Staff Evaluation. In LRA Section B.2.24, the applicant stated that the Lubricating Oil Analysis Program is an existing program that is consistent with GALL AMP XI.M39.

The staff reviewed those portions of the applicant's Lubricating Oil Analysis Program that the applicant claimed consistency with GALL AMP XI.M39 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff reviewed the applicant's Program Evaluation Document and confirmed that the program scope includes all in-scope mechanical components exposed to a lubricating oil environment. The staff held onsite interviews with the applicant's technical personnel to confirm these results. The staff finds the applicant's Lubricating Oil Analysis Program, as confirmed by the One-Time Inspection Program acceptable because it conforms to the recommended GALL AMP XI.M39.

Operating Experience. In LRA AMP B.2.24, the applicant provided the following operating experience evaluation for BVPS:

> The Lubricating Oil Analysis Program is an existing program that maintains oil systems free of contaminants (primarily water and particulates) thereby preserving an environment that is not conducive to loss of material, cracking, or fouling. Program activities include sampling and analysis of lubricating oil for contaminants, water, particulates, and bearing wear materials.
>
> Analysis of samples taken in 2006 from lube oil subsystems for several in-scope pumps and motors showed that the oil in these components was within normal tolerances and was satisfactory for continued use. However, the presence of elevated amounts of water, wear particles, and contaminants in routine sampling led to documenting the issues in the Corrective Action Program. Use of warning level indicators to direct corrective actions prior to equipment degradation provides evidence that the program is effective in managing aging effects caused by oil impurities.
>
> The BVPS practice of regular lube oil system analysis is consistent with industry operating experience in which significant and potentially disabling failures could have been prevented by following this same policy. A specific example is described in NRC Information Notice, 2001-06 in which a 40-fold increase in

particle count for the lube oil in a high-head SI pump thrust bearing was not recognized as a potential indicator of bearing damage.

> Other good practices such as assessing the storage and distribution of lubricating oil from the site warehouse helps to ensure that high quality contaminant-free oil is added to the lubricating systems for in-scope pumps and motors.
>
> The BVPS Lubricating Oil Analysis Program incorporates operating experience from the sampling and testing of lubricating oil for the various in-scope pump and motor bearing packages. Operating experience has shown that a precursor event to bearing failures is elevated lubricating oil particulate concentration. The program is designed to detect this elevated particulate concentration which allows preemptive actions such as oil replacement to be performed prior to loss of intended function. Current operating experience (Corrective Action Program documents, Information Notices, etc.) validates the effectiveness of the BVPS Lubricating Oil Analysis Program. The BVPS Lubricating Oil Analysis Program has been effective at managing aging effects by periodically sampling and analyzing lubricating oil from these in-scope components.

The staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff also confirmed that applicable aging effects and industry and plant-specific operating experience have been evaluated and incorporated into the BVPS Lubricating Oil Analysis Program.

During the audit and review, the staff noted that the applicant's program is implemented through site-specific procedures and that the procedures incorporate appropriate American Society for Testing of Materials (ASTM) standards for the collection and testing of lubricating oil samples (*i.e.*, ASTM D 6595 for determining presence of wear materials and contaminants, and ASTM D 6304 for determining presence of water in lubricating oil), and other appropriate industry standards. The staff also confirmed that the plant-specific procedures contain the acceptance criteria in accordance with the industry standards upon which the procedures are based. The staff noted that when lubricating oil parameters are found outside of tolerances defined in the plant-specific procedures, the procedure directs that the condition is documented in the condition reporting process to determine causes and to effect appropriate corrective actions, including actions to revise the acceptance criteria or the sampling and testing frequencies, if required.

The staff noted that the applicant's program also incorporates industry operating experience such as that provided in NRC Information Notices (INs) and that the industry operating experience is evaluated to determine adverse trends that could impact the ability of the lubricating oil analyses to conservatively predict equipment failures. The staff noted that the applicant's program also is subject to periodic self assessments and QA reviews and that the applicant uses these quality reviews to insure that the program incorporates industry and plant-specific operating experience and to adjust the program elements of the AMP accordingly, if the need arises.

Based on its review, the staff finds that the applicant's Lubricating Oil Analysis Program has been effective in monitoring, controlling, and correcting the aging effects of components within the scope of this program because (a) the applicant is implementing its program in accordance with appropriate ASTM standards for monitoring of lubricating oil quality, (b) the applicant appropriately takes prompt corrective actions when the lube oil property and quality are out of specification with the ASTM standards, and (c) the program includes periodic self assessments and QA controls that are used to adjust and improve the programs based on past performance.

UFSAR Supplement. In LRA Section A.1.24, the applicant provided the UFSAR supplement for the Lubricating Oil Analysis Program. The staff reviewed this Section and determines that the information in the UFSAR Supplement provided an adequate summary description of the program, as required by 10 CFR 54.21(d), and is consistent with the guidance for the lubricating oil analysis program found in SRP-LR Table 3.1-2.

Conclusion. Based on its review, the staff finds the applicant's Lubricating Oil Analysis Program acceptable because it is consistent with the GALL Report and the plant is bounded by the conditions set forth in the GALL Report for this AMP. Based on its review, the staff finds that the applicant's program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.14 Metal Enclosed Bus Program (Unit 2)

Summary of Technical Information in the Application. In LRA, Section B.2.26, the applicant stated that the Metal Enclosed Bus Program is a new program that is consistent with GALL AMP XI.E4, "Metal Enclosed Bus."

The applicant stated that in-scope metal enclosed bus internal surfaces will be visually inspected for aging degradation of insulating and conductive components. This visual inspection will also identify evidence of foreign debris, excessive dust buildup, or moisture intrusion. The applicant further states that the bus insulating system, including the internal supports, will be visually inspected for structural integrity and signs of aging degradation. A sample of accessible bolted connections will be checked for loose connection using thermography. The applicant will complete inspections prior to the period of extended operation and every 10 years thereafter.

Staff Evaluation. The staff reviewed the LRA and the applicant's onsite bases documents related to the Metal Enclosed Bus Program in which the applicant claimed consistency with GALL AMP X1.E4.

The staff reviewed the applicant's metal enclosed bus documents and confirmed them to be consistent with GALL AMP X1.E4. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and that the conditions at the plant are bounded by the conditions for which the GALL report is evaluated. The staff held onsite interviews with the applicant's technical personnel to confirm these results.

In LRA Section B.2.26, the applicant stated that the metal enclosed bus is only applicable to the 480 Vac metal enclosed bus feeders to emergency substations (2-8 and 2-9) for Unit 2. It also stated that there is no in-scope metal enclosed bus at Unit 1. The applicant stated that UFSAR

Section 8.4 for Units 1 and 2 complies with 10 CFR Part 50, Appendix A, Genera Design Criteria (GDC) 17. GDC 17 requires that two physical independent circuits be designed and located so as to minimize, to the extent practical, the likelihood of their simultaneous failure under operating and postulated accident conditions. Each of these circuits shall be designed to be available in sufficient time, following a loss of all onsite ac power supplies and the other offsite electric power circuit to assure that specified acceptable fuel design limits and design conditions of the RCPB are not exceeded. One of these circuits shall be designed to be available within a few seconds following a loss-of-coolant accident to assure that core cooling, containment integrity, and other vital safety functions are maintained. These offsite circuits are relied on in analyses or plant evaluations to perform a function that demonstrates compliance with the station blackout (SBO) rule, 10 CFR 50.63, and should be included within the scope of license renewal in accordance with 10 CFR 54.4(a)(3).

In RAI B.2.26-1, dated May 15, 2008, that staff requested that the applicant (a) describe the two independent offsite circuits and their associated metal enclosed buses *(i.e.*, iso-phase and non-segregated) and (b) explain why other metal enclosed buses (*e.g.*, iso-phase metal enclosed buses) are not included within the scope of the Metal Enclosed Bus Program.

In its response to RAI B.2.26-1, dated June 17, 2008, the applicant stated that LRA Figure 2.5-1 shows that Unit 1 receives offsite power from the 138kV switchyard. The 138kV bus #1 (switchyard breaker 92) is connected to the high-voltage side of the 138kV/4.16kV system station service transformer (TA-1A) via overhead and transmission conductor. The low voltage side of the 138kV/4.16kv system station service transformer (TR-1A) is connected to 4.16kV nonsafety-related bus (1A) via insulated cables. The nonsafety-related bus (1A) supplies the safety bus (1AE) via insulated cables. The applicant further stated that LRA Figure 2.5-1 also shows that the 138kV Bus #2 (switchyard circuit breaker 83) is connected to the high-voltage side of the 138kV/4.16kV system station service transformer (TR-1B). This connection is made via the switchyard bus and overhead transmission conductor. The low voltage side of the 138kV/4.16 kV system station service transformer (TR-1B) is connected to 4.16 kV nonsafety-related bus (1D) via insulated cables, which supplies the safety bus (1DF) via insulated cables.

The applicant also stated that LRA Figure 2.5-2 shows that Unit 2 receives offsite power from the 138kV switchyard. The 138kV bus #2 (switchyard breaker 85) is connected to the high-voltage side of the 138kV/4.16kV system station service transformer (TA-2A) via overhead transmission conductors. The low voltage side of the 138kV/4.16kv system station service transformer (TR-2A) is connected to the 4.16kV nonsafety-related bus (2A) via insulated cables. The nonsafety-related bus (2A) supplies the safety-related bus (2AE) via insulated cables. In addition, the applicant stated that LRA Figure 2.5-2 also shows that the 138kV Bus #1 (switchyard circuit breaker 94) is connected to the high-voltage side of the 138kV/4.16 kV system station service transformer (TR-2B) via overhead transmission conductors. The low voltage side of the 138kV/4.16kV system station service transformer (TR-2B) is connected to the 4.16 kV nonsafety-related bus (2D) via insulated cables, which supplies the safety-related bus (1DF) via insulated cables. The applicant further stated that in response to part (a) of this RAI and as shown in LRA Figures 2.5-1 and 2.5-2, the commodity group metal enclosed bus is not used in the offsite power paths for Units 1 and 2. Therefore, no metal enclosed bus for the offsite power path is included within the scope of license renewal. Lastly, the applicant stated that the only metal enclosed bus within the scope of license renewal is the Unit 2 Section of the 480V bus which is addressed in LRA Section B.2.26.

Based on its review, the staff finds the applicant's response to RAI B.26-1 acceptable because the applicant has adequately described the two independent offsite circuits pursuant to 10 CFR Part 50, Appendix A, GDC 17 and their associated components for both Units 1 and 2.

The staff also finds that the applicant has adequately explained why other metal enclosed buses (other than the Unit 2 Section of 480V bus) are not within the scope of its Metal Enclosed Bus Program. Therefore, the staff's concern described in RAI B.2.26-1 is resolved.

Operating Experience. The staff reviewed the operating experience reports, including a sample of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The applicant states in LRA Section B.2.26 that the Metal Enclosed Bus Program is a new AMP for which there is no plant-specific operating experience for program effectiveness. The applicant also stated that industry and plant-specific operating experience will be evaluated in the development and implementation of this program. The applicant further stated that as additional operating experience is obtained, lessons learned will be appropriately incorporated in the program. GALL AMP XI.E4, under Operating Experience, states that industry operating experience has shown that failures have occurred on metal enclosed buses by cracked insulation and moisture or debris buildup internal to metal enclosed buses. Experience also has shown that bus connections in metal enclosed buses exposed to appreciable ohmic heating, during operation, may experience loosening due to repeated cycling of connected loads.

In RAI B.2-1, dated May 22, 2008, the staff requested that the applicant address plant-specific operating experience.

In its response to RAI B.2-1, dated August 22, 2008, the applicant stated that during a 2003 4kV bus inspection on a Unit 1 metal enclosed bus of similar design and material but not in-scope of for license renewal, the applicant found that several insulator bolts were loose and one missing in a bus cubicle. The applicant entered this degraded condition into the FENOC Corrective Action Program. The applicant re-torqued the loosened bolts to the vendor recommended value and through an engineering evaluation, addressed the missing bolt. As a result of this inspection, the applicant performed an unplanned inspection of an additional cubicle and found no problems.

Based on its review, the staff finds that applicant response to RAI B.2-1 acceptable because the applicant adequately discussed the operating experience associated with components of the Metal Enclosed Bus program, including past corrective actions that resulted in program enhancements. The staff finds that this information should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that structure and component intended function(s) will be maintained during the period of extended operation. The staff notes that the applicant also has committed to evaluate industry and plant-specific operating experience in the development and implementation of this program. As the applicant obtains additional operating experience, it will appropriately incorporate lessons learned in the program. Therefore, the staff's concern described in RAI B.2-1 is resolved.

The staff confirms that the "operating experience" program element satisfies the recommendation in the GALL report and the guidance in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. The staff reviewed this Section and determines that the information in the UFSAR supplement provides an adequate description of the program as required by 10 CFR 54.21(d). The staff also verified that applicant has committed (Commitment No. 16 in UFSAR Supplement Table A.5-1) to implement its new Metal Enclosed Bus Program.

Conclusion. Based on its review, the staff finds that the applicant's Metal Enclosed Bus Program acceptable because it is consistent with the GALL report and the plant is bounded by the conditions set forth in the GALL Report for this AMP. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d)

3.0.3.1.15 Metal Fatigue of Reactor Coolant Pressure Boundary Program

Summary of Technical Information in the Application. In LRA Section B.2.27, the applicant described the existing Metal Fatigue of Reactor Coolant Pressure Boundary Program as consistent with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary."

The applicant stated that the Metal Fatigue of Reactor Coolant Pressure Boundary Program is a TLAA that uses preventive measures to mitigate fatigue cracking caused by anticipated cyclic strains in metal components of the RCPB. The preventive measures monitor and track critical thermal and pressure transients for RCS components to prevent them from exceeding fatigue design limits. Critical transients are the subset of the design transients likely to approach or exceed the number of design cycles during the sixty-year operating life of the units. These critical transients include plant heatup, plant cooldown, reactor trip from full power (Unit 1), inadvertent auxiliary spray, safety injection activation (Unit 1), and RCS cold over-pressurization. The program also monitors supplemental transients like the pressurizer insurge transient, selected chemical and volume control system (CVCS) transients, auxiliary feedwater (AFW) injections, and RHR actuation (Unit 2). Before these transients exceed the fatigue design limit, the program triggers preventive or corrective actions or both.

In addition, the applicant also stated that the program evaluates environmental effects in accordance with the guidance in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves for Selected Nuclear Power Plant Components," and EPRI Technical Report Materials Reliability Program (MRP)-47, "Guidelines for Addressing Fatigue Environmental Effects in a License Renewal Application." The program evaluates selected components using material-specific guidance found in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low Alloy Steels," and in NUREG/CR-5704,"Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels."

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

Specifically, the staff reviewed the "scope of program" "preventative/mitigative actions," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria" and "operating experience" program elements of the applicant's Fatigue of

Reactor Coolant Pressure Boundary Program against the staff's recommended criteria for these programs that are provided in the corresponding program elements of GALL AMP X.M1. The staff performed its review of the "corrective actions," "confirmatory actions," and "administrative controls" program elements as part of the staff's review of the applicant's Quality Assurance Program.

The staff's evaluation of the Quality Assurance Program is provided in SER Section 3.0.4.

The staff reviewed the technical information in LRA Section B.2.27 and the applicant's onsite documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL Report. The staff also interviewed the applicant's technical staff to verify the description of the LRA and its supplementing documents.

The staff determined that the applicant's Metal Fatigue of Reactor Coolant Pressure Boundary Program is based, in part, on a cycle counting process that is performed for the design basis transients that have been defined for the Units 1 and 2 facilities in LRA Table 4.3-2. The staff noted that the cycle counting is required for these transients in accordance with the applicant's Technical Specification (TS) 5.5.3, which reads as follows:

> 5.5.3 Component Cyclic or Transient Limit
>
> This program provides controls to track the UFSAR Table 4.1-10 (Unit 1) and UFSAR Table 3.9N-1 (Unit 2), cyclic and transient occurrences to ensure that components are maintained within the design limits.

The staff noted that this TS requirement provided the applicant's basis for the cycle counting that is part of the "monitoring and trending" program element aspect of the applicant's program. However, in comparing other aspects of the applicant's program elements to the -program element criteria in GALL AMP X.M1, the staff found that LRA Section B.2.27 did not provide sufficient detail for the staff to determine whether the "Metal Fatigue of Reactor Coolant Pressure Boundary Program" is adequate for the period of extended operation. The staff therefore issued to the applicant a number of RAIs on the Metal Fatigue of Reactor Coolant Pressure Boundary Program.

The staff noted that the applicant defines the term "critical transients" and provides the lists of the transients for each unit in the LRA Table 4.3-2. The staff issued an RAI for its clarification and review.

In RAI B.2.27-1, dated May 28, 2008, the staff requested that the applicant provide a list of the critical design basis transients that could impact the cumulative usage factor (CUF) assessments for the applicant and to justify its basis for selecting these transients as the critical ones for the CUF calculation.

In its response to RAI B.2.27-1, dated July 11, 2007, the applicant identified the critical transients, which include plant heat up and cool down, reactor trip from full power (Unit 1 only), inadvertent auxiliary spray, safety injection activation (Unit 1 only) and RCS cold over pressurization, that will be monitored by Metal Fatigue of Reactor Coolant Pressure Boundary Program. The applicant further identified supplemental transients, which include pressurizer insurge transient, selected CVCS transients, AFW injections and RHR actuation that will be monitored by Metal Fatigue of Reactor Coolant Pressure Boundary Program and stated that these critical and supplemental transients will be monitored and tracked in order to ensure that the fatigue design limit is not exceeded. The staff noted that as part of the response, the applicant provided a table of the critical and supplemental transients that are required for monitoring for Units 1 and 2, along with the basis of selection and the selection criteria of these transients. The staff further noted that the applicant selected these critical and supplemental transients because the projected cycles for these transients are expected to approach the design cycles during the period of extended operation.

Based on its review, the staff finds the applicant’s response to RAI B.2.27-1 acceptable because the applicant has provided the complete list of critical and supplemental transients that will be monitored by the Metal Fatigue of Reactor Coolant Pressure Boundary Program and has included an appropriate basis for selecting these transients to be monitored by the program during the period of extended operation. Therefore, the staff’s concern described in RAI B.2.27-1 is resolved.

In LRA Section B.1.3, the applicant provided the following elements: (a) corrective actions, (b) confirmation process, and (c) administrative controls common to all AMPs. The staff issued an RAI in order to verify the specific activities for those elements under this program.

In RAI B.2.27-2, dated May 28, 2008, the staff requested that the applicant provide the information on the design transient cycle-based acceptance criterion that will be used to initiate corrective actions if the criterion is exceeded, and provide a discussion on what these follow-up corrective actions would entail if the acceptance criterion is exceeded and the process is incorporated into the plant-specific implementation procedure for the Metal Fatigue of Reactor Coolant Pressure Boundary Program.

In its response to RAI B.2.27-2, dated July 11, 2007, the applicant stated that, as part of the implementing procedure for the Metal Fatigue of Reactor Coolant Pressure Boundary Program, the number of accumulated cycle occurrences for the critical transients, including the supplemental transients, is updated on an annual basis to determine and identify any adverse trends, adverse conditions and deficient conditions. The applicant defined the terms “adverse trend,” “adverse condition” and “deficient condition” as they apply to the implementing procedure for the Metal Fatigue of Reactor Coolant Pressure Boundary Program. The applicant clarified that the intent of its implementing procedure is to detect adverse trends and adverse conditions early on, so that the likelihood of a deficient condition can be prevented. The applicant further indicated that it will perform an evaluation to determine when a rigorous analysis or an alternate solution is needed. When an adverse trend or condition has occurred the deficient condition(s) will be addressed with the applicant’s Corrective Actions Program.

Based on its review, the staff finds the applicant’s response to RAI B.2.27-2 acceptable because the applicant clarified the triggering points associated with the implementing procedures of the Metal Fatigue of Reactor Coolant Pressure Boundary Program and the applicant’s procedures initiate corrective actions prior to the loss of the components intended function. Therefore, the staff’s concern described in RAI B.2.27-2 is resolved.

The staff noted that in LRA B.2.27, the applicant indicated that supplemental transients are identified by the Metal Fatigue of Reactor Coolant Pressure Boundary Program for monitoring. The staff required additional information in order to complete its review of this program.

In RAI B.2.27-7, dated May 28, 2008, the staff requested that the applicant provide additional information related to the supplemental transients identified by the program for monitoring. Specifically, the applicant was asked to (a) identify the major components affected by the transients and confirm that a related fatigue analysis has been updated; (b) justify consistency between supplemental transients and design transients, (c) explain the method used to monitor these transients, and indicate whether the number of design cycles for the supplemental transients will remain valid for the period of extended operation.

In its response to RAI B.2.27-7, dated July 11, 2007, the applicant clarified that all supplemental transients listed in the LRA are applicable to both Units 1 and 2. The applicant continued in its response by listing those components that are affected by each of the transients (pressurizer insurge/outsurge, selected CVCS, AFW injection and RHR activation). The staff noted that the applicable analyses for the components specified by the applicant have incorporated the corresponding transients affecting these components and do not require a revision, with the exception of the ASME Class 1 portion of the Unit 2 charging piping. The applicable analyses for the ASME Class 1 portion of the Unit 2 charging piping is part of the applicant's commitment (Commitment No. 1) to perform a re-analysis and to incorporate the revised design cycles of the selected CVCS transients.

The applicant stated that the AFW injection transient was incorporated into the original analysis for the Unit 2 reactor coolant pumps (RCPs), pressurizer and loop stop valves. However, Westinghouse did not identify this transient in the NSSS transients and; therefore, it was not a part of the original design basis. The applicant specifically added this transient for the SGs as part of the design basis for the extended power uprate. The staff noted that the RHR Activation for Unit 2 was part of the original design basis, and was considered a supplemental transient because the applicant expected that the cycles would exceed the design cycles. However based on its response to RAI B.2.27-4, the applicant no longer expects these cycles to exceed the design cycles.

The staff noted that in its response to RAI B.2.27-7, the applicant is capable of monitoring the pressurizer insurge/outsurge, selected CVCS and AFW injection transient with the use of the Plant Computer data archiving system. The staff further noted that with the use of the Plant Computer, the applicant is able to identify the pressurizer insurge/outsurge transient via the surge line thermocouple that will detect a delta-temperature and allocate it into a pre-existing band of delta-temperatures. The applicant explained that the selected CVCS transients are identified with the use of the Plant Computer by noting the valve positions and that the AFW injection transient can be identified by noting the operation and system flow rates of the AFW pumps during Plant Mode 1, 2 and 3. As discussed in the staff's evaluation of RAI B.2.27-4, RHR activation can be identified when the plant transitions between Mode 3 and Mode 4.

Based on its review, the staff finds that the applicant has provided sufficient detail pertaining to the supplemental transients identified by the applicant, the components affected by these transients and the method of monitoring and identification of these transients during the period of extended operation. The staff concludes that, based on its review, the adequate information provided by the applicant, and the fact that the applicant has committed to re-analyzing the Unit 2 charging piping to incorporate the revised design cycles, the applicant's response is acceptable. Therefore, the staff's concern described in RAI B.2.27-7 is resolved.

During the audit, the staff reviewed the onsite basis documents supporting the LRA and discussed its review with the applicant. The staff found that LR basis document (FMP Program Document LRBV-PED-X.M1) Table 6.0-1, element 10 stated that "The design transient assumed by original design analysis will be sufficient for 60 years operation." The staff noted this sentence is also stated in the operating experience Section of LRA Section B.2.27. However, the annotation (a) of LRA Table 4.3-1 states that the projected 60-year cycles of RHR system piping are expected to exceed the design cycles by 50 percent.

In RAI B.2.27-4, dated May 28, 2008, the staff requested that the applicant justify the discrepancy between the text in the LRA and onsite basis documents and the annotation (a) of LRA Table 4.3-1.

In its response to RAI B.2.27-4, dated July 11, 2007, the applicant stated that for the location with the annotation (a), RHR System Piping, the transient that is of concern is "Placing RHR in Service," which occurs at approximately 350°F during plant shutdown procedures. The applicant further stated that Westinghouse performed its initial counting of this transient assuming that it occurs every time the plant transitions from Mode 3 (Hot Shutdown) to Mode 4 (Cold Shutdown), which is documented in Westinghouse Commercial Power (WCAP)-16173-P. The staff verified in the applicant's UFSAR and TSs that RHR is placed into service when the plant cools down from 350° F to less than 200° F. The applicant noted that this method of counting is very dependent on an accurate account of the plant modes and the transition between Mode 3 and Mode 4.

The staff noted that the applicant had performed an evaluation, to obtain an accurate count from the plant mode history from Power Ascension Testing until October 15, 2003. The applicant's result from this recount was 31 events compared to Westinghouse's count of 85 events. The staff compared the results of the applicant's recount with LRA Table 4.3-2 and noted that Unit 2 has had 30 plant cooldown cycles.

Based on its review, the staff finds the applicant's response to RAI B.2.27-4 acceptable because the applicant performed an evaluation to determine an accurate count of the "Placing RHR in Service" transient and has demonstrated that its new count is reasonable, since the transient has occurred every time the plant experienced the transient "Plant Cooldown." Therefore, the staff's concern described in RAI B.2.27-4 is resolved.

In LRA Table 4.3-2, the applicant provided the design transients for the transient cycle projection. Plant program basis document ADM 2115 also provides those transients. The staff noted that the design transients were inconsistent with those in the latest associated piping design specification. The staff determined that additional information was required In order to confirm the consistency between the documents.

In RAI B.2.27-5, dated May 28, 2008, the staff requested that the applicant provide a comparison of the design transients in the LRA table and the basis document and the transients in the latest associated piping design specification documents for Unit 2. The staff also requested that the applicant justify any discrepancy between the LRA table and plant documents (ADM 2115 and design specification).

In its response to RAI B.2.27-5, dated July 11, 2007, the applicant confirmed that there are no discrepancies between LRA Table 4.3-2 and its plant documents, which include AMD 2115 and the design specifications.

Based on its review, the staff finds the applicant's response to RAI B.2.27-5 acceptable because the applicant has confirmed that there are no discrepancies between LRA Table 4.3-2 and its plant documents. Therefore, the staff's concern described in RAI B.2.27-5 is resolved.
The staff noted during its review of the applicant's basis document that the design transient, RHR actuation (activation), for Unit 1 does not require monitoring. The staff determined that additional information was required in order to complete its review.

In RAI B.2.27-9, dated May 28, 2008, the staff requested that the applicant justify the basis for not monitoring the Unit 1 design transient, RHR actuation, for the period of extended operation.

In its response to RAI B.2.27-9, dated July 11, 2007, the applicant stated that the RHR system tee for Unit 1 is a NUREG/CR-6260 location that has been evaluated for environmentally assisted fatigue. The applicant further stated that this location was originally designed to the American National Standards Institute (ANSI) B31.1 standard and re-evaluated under American Society of Mechanical Engineers (ASME) Code Section III to determine a CUF. The staff noted that the applicant has amended the LRA to include an enhancement to the Metal Fatigue of Reactor Coolant Pressure Boundary Program to require that the design transient, RHR Activation for Unit 1 be monitored. The applicant committed (Commitment Nos. 25 and 26 for Units 1 and 2, respectively) to monitor transients in which the 60-year projected cycles are used in environmentally assisted fatigue evaluations.

Based on its review, the staff finds the applicant's response to RAI B.2.27-9 acceptable because the applicant has amended the LRA and has committed (Commitment No.25) to monitor the RHR activation transient for Unit 1 with the Metal Fatigue of Reactor Coolant Pressure Boundary Program. Therefore, the staff's concern described in RAI B.2.27-9 is resolved.

During the onsite discussion, the applicant stated "the surge line to hot leg nozzle for Units 1 and 2, is included in a stress and fatigue model to be used in an on-line monitoring system. The staff determined that additional information was required in order to complete its review.

In RAI B.2.27-3, dated May 28, 2008, the staff requested that the applicant explain the purpose of the on-line monitoring system (WESTEMS) in the management of components subject to metal fatigue, including NUREG/CR-6260 components for the period of extended operation. The staff also requested that the applicant provide its benchmarking results for the WESTEMS software, using relevant transient data and proper 3-D modeling, and justify the use of this software to update the CUF calculation, using the monitored or projected transient data (cycles).

In its response to RAI B.2.27-3, dated July 11, 2007, the applicant stated that WESTEMS is used only in the analysis of the pressurizer lower shell and related components and the surge line to hot leg nozzle for both Units 1 and 2 and the pressurizer spray nozzle of Unit 1. The applicant further stated that the analysis for each location is different and continued to describe how WESTEMS is used for aging management for each of the locations listed above, as requested by the staff.

Westinghouse collaborated on the applicant's response by providing an explanation of the methods utilized by the WESTEMS software in performing the fatigue evaluations for the locations listed above. In addition, Westinghouse provided the applicant with its benchmarking results, accompanied by several graphs that compared the stress results generated from WESTEMS fatigue analysis software and those generated from the traditional finite element ANSYS analysis. The staff noted from the graphs provided by Westinghouse that the difference between the stress results generated by WESTEMS and ANSYS, was negligible.

Based on its review, the staff finds the applicant's response to RAI B.2.27-3 acceptable because the applicant has provided adequate information pertaining to the use of WESTEMS system at Units 1 and 2 and that there is a negligible difference between the stress results generated by WESTEMS and ANSYS. Therefore, the staff's concern described in RAI B.2.27-3 is resolved.

In LRA Section 4.3.2.2, the applicant indicated that the Metal Fatigue of Reactor Coolant Pressure Boundary Program monitors the transients associated with non-regenerative (letdown) heat exchanger, regenerative heat-exchanger, and RHR heat exchangers. However, LRA Section B.2.27 did not indicate that monitoring of the relevant transients will be provided by this AMP.

In RAI B.2.27-10, dated May 28, 2008, the staff requested that the applicant provide a list of the transients associated with the heat exchangers, identify which of these transients are monitored by the program, and explain what corrective actions are taken when the current analyses are not bounding for 60 years of operation.

In its response to RAI B.2.27-10, dated July 11, 2007, the applicant clarified that all auxiliary system heat exchangers, which include letdown heat exchanger, regenerative heat exchanger and RHR heat exchangers, for both Unit 1 and 2 are installed on the Class 2 part of the their respective systems and the primary side of these auxiliary heat exchangers were designed in accordance with ASME Code Section III, Class 2 requirements. The staff noted that since these heat exchangers were designed in accordance with ASME Code Section III, Class 2 rules, a fatigue analysis in accordance with the ASME Code Section III Class 1 requirements is not applicable. The staff further noted that the expected total number of thermal cycles for the heat exchangers in question will be less than the 7000 thermal cycles required by ASME Code Class 2 thermal analysis and: thus, monitoring or a fatigue re-analysis is not required. The applicant amended LRA Sections 4.3.2.2 and A.3.3.2.2 and associated sub-sections and added LRA Section A.2.3.2.2 to reflect the discussion above. The staff noted that since these heat exchangers are bounded by 7000 equivalent full-temperature cycles for 60 years of operation, they will no longer be dispositioned under 10 CFR 54.21(c)(1)(iii), where the Metal Fatigue of Reactor Coolant Pressure Boundary Program will be used for monitoring; rather, they will be dispositioned under 10 CFR 54.21(c)(1)(i), where by the TLAA remains valid for the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI B.2.27-10 acceptable because the applicant has verified that the heat exchangers in question are designed under ASME Code Section III, Class 2 rules, and have been evaluated such that they will not exceed the 7000 equivalent full-temperature cycles and; thus, will not be monitored under the Metal Fatigue of Reactor Coolant Pressure Boundary Program. Therefore, the staff's concern described in RAI B.2.27-10 is resolved.

Enhancements. Enhancement 1 - The staff noted in the LRA that the applicant did not identify its Metal Fatigue of Reactor Coolant Pressure Boundary Program as AMP that is consistent with GALL AMP X.M1, with enhancement. The staff determined that additional information was required to complete its review.

In RAI B.2.27-6, dated May 28, 2008, the staff requested that the applicant provide additional information on the components that are within the scope of the program, how the program monitors for the impact of thermal transients on the CUFs for critical locations, how the program is updated to perform periodic updates of the CUF calculations for ASME Code Class 1 components, and how the program accounts for environmentally assisted fatigue on the CUF values for critical ASME Code Class 1 locations in the RVs and RCS piping.

In its response to RAI B.2.27-6, dated July 11, 2007, the applicant amended LRA Section B.2.27 to provide the program elements of the Metal Fatigue of Reactor Coolant Pressure Boundary Program and to provide the following enhancement that will affect the "preventive actions," "parameters monitored/inspected," and "corrective actions" program element of the program:

> Add a requirement that fatigue will be managed for the NUREG/CR-6260 locations. This requirement will provide that management is accomplished by one or more of the following:
>
> (1) Further refinement of the fatigue analyses to lower the predicted CUFs to less than 1.0;
>
> (2) Management of fatigue at the affected locations by an inspection program that has been 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); or,
>
> (3) Repair or replacement of the affected locations.
>
> Add a requirement that provides for reanalysis, repair, or replacement of the Unit 2 steam generator secondary manway bolts and the steam generator tubes such that the design bases of these components are not exceeded for the period of extended operation.

The staff reviewed this enhancement, noting that with respect to the applicant's option to refine the CUF analyses to maintain the predicted CUFs to less than a design-basis CUF limit of 1.0, (a) the option is consistent with the staff's recommended "preventative actions" program element in GALL AMP X.M1; (b) the fatigue usage factor will be maintained below the design code limit, taking into account the effects of the reactor water environment; and (c) with the staff's recommended "detection of aging effects," program element in GALL AMP X.M1 will be used to perform periodic updates of the CUF calculations.

With respect to the applicant's options to either refine the fatigue analysis for impacted ASME Code Class 1 compacts or to repair or replace the impacted locations, the staff noted that the applicant's options are consistent with the staff's recommended "corrective actions" program element in GALL AMP X.M1. This GALL AMP states that acceptable corrective actions for these type of AMPs include either repair or replacement activities on the impacted locations or more rigorous analyses of the impacted components to demonstrate that the design-basis code limit of 1.0 for CUFs will not be exceeded during the extended period of operation. The staff further noted that, since this AMP is credited with acceptance of the TLAA on environmentally-assisted metal fatigue of AMSE Code Class 1 components, the applicant's option to manage the impact of environmentally-assisted metal fatigue, and to monitor for fatigue-induced cracking using an inspection-based program, was in accordance with the staff's criterion for accepting TLAAs pursuant to 10 CFR 54.21(c)(1)(iii), where by the effects of aging will be managed for the period of extended operation.

The staff verified that the applicant incorporated this enhancement as part of revised Commitment No. 25 in UFSAR Supplement Table A.4-1 for Unit 1 and revised Commitment No. 26 in UFSAR Supplement Table A.5-1 for Unit 2.

Based on its review, the staff finds that this aspect of the applicant's enhancement is acceptable. The staff also finds the applicant's response to RAI B.2.27-6 acceptable because the applicant has enhanced the Metal Fatigue of Reactor Coolant Pressure Boundary Program such that it is consistent with the recommendations provided in the program elements, "preventative actions", "detection of aging effects" and "corrective actions" of GALL AMP X.M1 or with the acceptance criterion in 10 CFR 54.21(c)(1)(iii). The staff further finds that the applicant has reflected this enhancement in the revised Commitment No. 25 in UFSAR Supplement Table A.4-1 for Unit 1 and No. 26 in UFSAR Supplement Table A.5-1 for Unit 2. Therefore, the staff's concern in RAI B.2.27-6 is resolved.

As part of the applicant's response to RAI 4.3-2, the staff noted that the applicant included, as part of this enhancement to the Unit 2 Metal Fatigue of Reactor Coolant Pressure Boundary Program, that the applicant will re-analyze, repair, or replace the Unit 2 SG secondary manway bolts and SG tubes for the period of extended operation. The staff verified that the applicant has incorporated this enhancement as part of revised Commitment No. 26 for Unit 2, as provided in UFSAR Supplement Table A.5-1. The staff also verified that this enhancement for the Unit 2 SG secondary manway bolts and SG tubes is consistent with the recommendations in the "corrective actions" program element of GALL AMP X.M1 which states that "acceptable corrective actions include repair of the component, replacement of the component, or a more rigorous analysis of the impacted component to demonstrate that the design code limit will not be exceeded during the extended period of operation."

Based on its review, the staff finds that this aspect of the applicant's enhancement is acceptable because it is consistent with the recommendations that are provided in the program elements of GALL AMP X.M1, as described above, and because the applicant has reflected this enhancement in revised Commitment No. 26 in UFSAR Supplement Table A.5-1 for Unit 2.

Enhancement 2 - The staff noted that in the LRA, the applicant did not identify its Metal Fatigue of Reactor Coolant Pressure Boundary Program as an AMP that is consistent with GALL AMP X.M1, with enhancement. In its audit of the license renewal basis document for the Metal Fatigue of Reactor Coolant Pressure Boundary Program, the staff noted that the applicant stated that the design basis transient monitoring for actuation of the Unit 1 RHR system was not required.

In RAI B.2.27-9, dated May 28, 2008, the staff requested that the applicant provide its basis for concluding that actuations of the BVPS Unit 1 RHR system did not require cycle counting when the new 60-year ASME Code Section III CUF analysis and environmentally-assisted fatigue analysis for the limiting Unit 1 RHR nozzle was impacted by this transient.

In its response to RAI B.2.27-9, dated July 11, 2008, the applicant amended LRA Section B.2.27 to incorporate this enhancement which affects the program element, "parameters monitored/inspected." The enhancement states the following:

> Add a requirement that provides for monitoring of the Unit I RHR Activation transient and establishes an administration limit of 600 cycles for the transient.
>
> Add a requirement to monitor Unit I and Unit 2 transients where the 60-year projected cycles are used in the environmental fatigue evaluations, and establish an administration limit that is equal to or less than the 60-year projected cycles number.

The applicant also stated that it had to perform a new 60-year ASME Code Section III-based CUF analysis and a new 60-year environmentally-assisted fatigue-based CUF analysis because the component was designed to ANSI B.31.1 design standards. The applicant also stated that, the new 60-year ASME code Section III-based and environmentally-assisted fatigue-based CUF calculations were based on the assumption of 600 cycles of RHR system actuations. The applicant stated that as a result of the new calculations, the Metal Fatigue of Reactor Coolant Pressure Boundary Program will be amended and enhanced to include (a) a new cycle monitoring requirement for the BVPS Unit 1 RHR actuation transient and (b) a new requirement to establish 600 cycles of RHR actuation as the cycle-based acceptance criterion for monitored RHR actuations at BVPS Unit 1.

The staff noted that as part of this enhancement, the applicant is adding a requirement to monitor the Unit 1 RHR activation transient where the 60-year projected cycles may approach the analyzed number of cycles during the period of extend operation. The staff further noted that for the remaining Unit 1 and 2 transients whose 60-year projection cycles were used in the fatigue evaluations of the NUREG/CR-6260 recommended locations, the applicant also will monitor with the Metal Fatigue of Reactor Coolant Pressure Boundary Program and will require that an administration limit be established that is equal to or less than the 60-year projected cycles number.

The applicant stated that these changes would be reflected in an amendment of the LRA. The staff verified that the applicant has amended LRA Section B.2.27. The staff also verified that the applicant has incorporated this enhancement to the Metal Fatigue of Reactor Coolant Pressure Boundary Program in its revision of Commitment No. 25 in UFSAR Supplement Table A.4-1 for Unit 1 and in its revision of Commitment No. 26 in UFSAR Supplement Table A.5-1 for Unit 2.

Based on its review, the staff finds the applicant's response to RAI B.2.27-9 acceptable because the applicant has (a) amended the LRA and has committed (Commitment No. 25) that the Unit 1 RHR activation transient will be monitored with the Metal Fatigue of Reactor Coolant Pressure Boundary Program and (b) set an administration limit for the Unit 1 RHR activation transient so that corrective actions will be initiated prior to loss of the components intended functions. Therefore, the staff's concern described in RAI B.2.27-9 is resolved.

Operating Experience. In LRA Section B.2.27, the applicant stated that the Corrective Action Program documented concerns for the overall health of the transient/cycle counting program. Corrective actions identified a program owner, developed an administration program document and updated it to incorporate responsibilities, improved cycle counting, and established a process for engineering to evaluate plant data. Fatigue monitoring, to date, indicates that the number of design transient events assumed in the original design analysis will be sufficient for a 60-year operating period. The applicant also stated that the program has remained responsive to emerging issues and concerns, particularly the pressurizer surge and spray nozzle, hot leg surge nozzle, and surge line transients.

For example, the applicant stated that in 2002, a Westinghouse evaluation found that the Unit 2 letdown, charging, and excess letdown piping could exceed their design allowable cycle counts for several design transients; however, further evaluation of existing plant operations and the physical separation distance of the letdown and excess letdown piping indicated that no further evaluation of the piping was required for current operation or for the period of extended operation. A re-analysis of the charging piping was required to account for the appropriate transients for a 60-year plant life.

The applicant further stated that this responsiveness to emerging issues and continued program improvements prove that the program will remain effective in managing cumulative fatigue damage for passive components.

The staff reviewed the operating experience and selected condition reports associated with this AMP during the onsite audit, and interviewed the applicant's technical staff to confirm that the effects of aging will be managed adequately so that the system and component intended function(s) will be maintained during the period of extended operation. The staff noted that the LRA indicated a re-analysis of the charging piping was required to account for the appropriate transients for a 60-year plant life.

In RAI B.2.27-8, dated May 28, 2008, the staff requested that the applicant justify the basis for the applicant's determination that no further evaluation of the letdown or excess letdown piping was required and provide results from the re-analysis of the charging piping and its environmentally-assisted fatigue evaluation.

In its response to RAI B.2.27-8, dated July 11, 2007, the applicant provided an explanation of the transients that are of concern for the Class 1 portion of the Unit 2 charging, letdown and excess letdown systems and how they affect these systems. The applicant stated that the following three specific transients can affect the above mentioned systems: (1) isolation of letdown flow; (2) isolation of charging flow; and (3) placing excess letdown in service. The applicant further stated that based on the Westinghouse count provided in WCAP-16173-P, the 60-year projection for the Unit 2 charging, letdown and excess letdown transients would exceed the design limit during the period extended operation. As of October 15, 2003, Westinghouse identified there to be approximately 1,076 thermal cycles. This concern was addressed with the FENOC corrective actions program, at which time the applicant stated that follow-up investigations had indicated that the Westinghouse evaluation in WCAP-16173-P combined the three transients listed above as if they affected all the same components, which was conservative. The staff confirmed that these three transients do not affect the same components and the applicant provided an explanation of how each of the three transients affects the letdown piping and excess letdown piping.

Based on its review, the staff finds the applicant's response to RAI B.2.27-8 acceptable because the applicant has demonstrated that the charging, letdown and excess letdown transients do not affect the same components and; therefore, do not require further evaluation. The staff also finds that the applicant has provided reasonable detail as to how these transients affect the letdown and excess letdown piping. The staff further finds that the applicant has committed (Commitment No. 1) to perform a re-analysis for the applicable NUREG/CR-6260 locations, including the Unit 2 charging piping, and submit the results to staff, with a summary of how the analysis was performed, no later than October 15, 2008. Therefore, the staff's concern described in RAI B.2.27-8 is resolved.

By letter dated October 2, 2008 the applicant stated it, (a) has completed the re-analysis and provided the results and methodology which demonstrated that the CUF, including environmental factors for the NUREG/CR-6260 locations will remain below the code allowable limit of 1.0, except for the Units 1 and 2 pressurizer surge line to hot leg nozzle; (b) will manage the all NUREG/CR-6260 locations, including the Units 1 and 2 pressurizer surge line to hot leg nozzle, with the Metal Fatigue of Reactor Coolant Pressure Boundary Program; and (c) calculated the environmental correction life fatigue factor (*i.e.*, F_{en}) for stainless steels for those locations requiring re-analysis in accordance with NUREG/CR-5704.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.27, the applicant provided the UFSAR supplement summarizing the Metal Fatigue of Reactor Coolant Pressure Boundary Program. The staff reviewed the Section of the UFSAR Supplement and determines that it is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff reviewed the UFSAR Supplement summary description that was provided in LRA Section A.1.27 for the Metal Fatigue of Reactor Coolant Pressure Boundary Program. The staff verified that the applicant has committed (Commitments No. 25 in LRA Table A.4-1 and No. 26 in LRA Table A.5-1) to implementing the enhancements prior to the period of extended operation.

Conclusion. Based on its review of the applicant's Metal Fatigue of Reactor Coolant Pressure Boundary Program, the staff finds all program elements, with the enhancements discussed above, consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.16 Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads Program

Summary of Technical Information in the Application. In LRA Section B.2.29, the applicant described the existing Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program as consistent with GALL AMP XI.M11-A, "Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors (PWRs Only)."

The applicant stated that the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program is an existing condition monitoring program designed to manage the effects of primary water stress-corrosion cracking (PWSCC) in the nickel-alloy RV closure head penetration nozzles and their associated nickel-alloy pressure boundary welds.

Staff Evaluation. The NRC issued Order EA-03-009, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," February 11, 2003, to all holders of PWR operating licenses. The order required specific augmented inspections of RV closure heads and the associated nickel-alloy penetration nozzles in U.S. PWRs. The staff issued First Revised Order EA-03-009 on February 20, 2004, to clarify which locations of the PWR vessel head penetration nozzles were applicable to the Order. All PWR licensees in the U.S. were required to submit 20-day and 60-day responses to Order EA-03-009 and to First Revised Order EA-03-009 (henceforth collectively referred to in this evaluation as "the Order, as amended").

The staff's aging management recommendations and program element criteria for Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Programs are found in GALL AMP XI.M11-A and are based on the program elements aspects required for compliance with "the Order, as amended

The staff reviewed the information in LRA Section B.2.29, the applicant's license renewal basis document for this AMP, and other supporting information and documents that pertain to the procedural and implementation controls for this AMP, against the regulatory criteria summarized in this section. Based on its review, the staff verified that the applicant's program is based on the augmented inspection requirements in the "Order, as amended."

The staff also verified that the applicant has proceduralized the administrative, regulatory, and technical aspects of its program into both FENOC corporate-based and BVPS site-based procedures. The staff verified that the applicant has incorporated these aspects into the program elements for its Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program and that the program elements for the AMP were consistent with the staff's program element recommendations in GALL AMP XI.M11-A.

Based on its review, the staff finds that the applicant's program is acceptable because it is based on compliance with the "Order, as amended," and conforms with the staff's program element criteria recommended in GALL AMP XI.M11-A.

Consistent with the staff's statement on page 52743 of the staff's Statement of Consideration on *Federal Register Notice* Volume 73, No. 176, "10 CFR 50; Industry Codes and Standards; Amended Requirements; Final Rule," the applicant may update its program elements for the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program to reflect implementation of the new augmented inspection requirements in 10 CFR 50.55a(g)(6)(ii)(D) and ASME Code Case N-729-1 for nickel-alloy upper RV closure head penetration nozzle and their associated nickel-alloy welds without having to take an exception to the program elements recommended in GALL AMP XI.M11-A.

Operating Experience. The program description in GALL AMP XI.M11-A provides a sufficient description of the GL and Bulletins that formed the basis of the "Order, as amended." The NRC-issued documents contain an adequate description of industry operating experience on upper RV closure head penetration nozzle cracking. The operating experience discussion in these NRC-issued generic communications and in the "Order, as amended," represents the relevant operating experience for this AMP. Relevant industry-wide operating experience from industry-wide nuclear utility inspections pursuant to the "Order, as amended," confirmed that the "Order, as amended" was necessary. These additional industry operating events need not be cited by the applicant to justify the existence of the applicant's Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program and its program elements because the NRC's issuance of the "Order, as amended," already achieves that objective.

The applicant's "operating program" program element discussion for the AMP identified that the program is being implemented pursuant to the "Order, as amended." The applicant identified that in March 2006, it had replaced the upper RV closure head for Unit 1 with an RV closure head fabricated from Alloy 690 materials. The applicant stated that this puts the Unit 1 RV closure head in the "replaced" ranking category of the "Order, as amended." The staff confirms that the applicant's actions are in compliance with the requirements of the "Order, as amended," and that they conform with the staff's recommended "detection of aging effects," and "monitoring and trending" program element criteria in GALL AMP XI.M11-A and; therefore, are acceptable.

The applicant also identified that it had performed ultrasonic testing (UT) examinations of the upper RV closure head penetration nozzles at Unit 2 during RFO 12 (2006). The applicant stated that the UT examinations detected relevant flaw indications in a number of the unit's RV closure head penetration nozzles and that the impacted penetrations were repaired in accordance with accepted industry practices, and that followup examinations of the repaired nozzles passed the applicant's acceptance criteria.

The staff noted that from its review of the program evaluation document for this AMP, the applicant has indicated that the current susceptibility ranking for the Unit 2 RV closure head has been placed on the "high" susceptibility ranking. The applicant stated that subsequent required inspections of the Unit 2 RV closure head and its nozzles will be done in accordance with the NRC's inspection requirements for "high" susceptibility ranked RV closure heads. The staff also noted that the applicant has stated that it applies the acceptance criteria in the NRC's letter (*i.e.*, letter from R. Barrett [NRC] to Alex Marion [NEI], April 11, 2003) as the basis for evaluating any relevant flaw indications detected through the applicant's implementation of this program. The staff further noted that the applicant has indicated that it implements any required nozzle repairs or replacements in accordance with the repair/replacement requirements of ASME Code Section XI. Finally, the staff noted that the applicant's basis for inspecting the Unit 2 nozzle in accordance with the inspection criteria for “high” susceptible RV closure heads is consistent with the applicant’s last inspection findings on the Unit 2 RV closure head and its penetration nozzles.

The staff confirms that the applicant’s acceptance criteria and corrective actions comply with the corrective actions specified in the “Order, as amended,” and conform with the respective “acceptance criteria” and “corrective actions” program elements recommended in GALL AMP XI.M11-1 and; therefore, are acceptable. Based on this assessment, the staff concludes that the applicant has correctly addressed the relevant indications detected in the Unit 2 RV closure head nozzles.

Based on its review, the staff concludes that the “operating experience” program element for this AMP has been adequately addressed and is acceptable because the applicant has implemented a required AMP to address the relevant generic and BVPS-specific operating experience on nickel-alloy component cracking in upper RV closure head penetration nozzles and welds.

UFSAR Supplement. The applicant provided the UFSAR supplement summary description for its Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program in LRA Section A.1.29. The staff verified that, in LRA Section A.1.29, the applicant has clearly identified that the scope of the program is applicable to the upper RV closure head, the upper RV closure head penetration nozzles and any applicable nickel-alloy pressure boundary welds that are associated with these components. The staff confirms that this is consistent with the “scope of program” program element in GALL AMP XI.M11-A, and is acceptable. The staff also confirms that the applicant has provided an acceptable summary of the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program, which is designed to comply with the “Order, as amended,” and to implement the inspections that are mandated in the “Order, as amended.”

Based on its review, the staff concludes that UFSAR Supplement A.1.29 provides an acceptable summary description for the applicant’s Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program. The staff reviewed this Section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. Based on its review of the applicant’s Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program, the staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.17 One-Time Inspection Program

Summary of Technical Information in the Application. In LRA Section B.2.30, the applicant described the new One-Time Inspection Program as consistent with GALL AMP XI.M32, “One-Time Inspection.”

The applicant stated that it will implement the new One-Time Inspection Program prior to the period of extended operation. This program will require one-time inspections to verify effectiveness of the Water Chemistry Program, the Fuel Oil Chemistry Program, and the Lubricating Oil Analysis Program. One-time inspections may be needed to address concerns for certain aging effects on SCs for potentially long incubation periods. There are cases where either (a) an aging effect is not likely to occur but there is insufficient data to rule it out completely or (b) an aging effect is likely to progress very slowly. For these cases, the applicant stated that it will confirm that either the aging effect has not occurred or has occurred so slowly as not to affect any component or structure intended function during the period of extended operation. The one-time inspections will add assurance that either aging has not occurred or is so insignificant that no AMP is warranted.

The applicant further stated that the elements of the program will include:

- Determination of a representative sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience
- Determination of the inspection locations in the system or component based on the aging effect or areas susceptible to concentration of agents that promote certain aging effects
- Determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined
- Evaluation of the need for follow-up examinations to monitor any aging degradation.

In addition to verifying program effectiveness, the program verifies aging effects are not occurring in the following components:

- Loss of material of the steam generator feedwater ring
- Loss of material of selected bottoms of tanks that sit on concrete pads (by volumetric examination)
- Cracking of aluminum alloy moisture separators associated with the Unit 1 Emergency Diesel Generator Air Start System

When a one-time inspection reveals evidence of an aging effect, routine evaluation of the inspection results will indicate appropriate corrective actions.

<u>Staff Evaluation</u>. In LRA Section B.2.30, the applicant stated that the One-Time Inspection Program is a new program that is consistent with GALL Report AMP XI.M32.

The staff reviewed those portions of the applicant's One-Time Inspection Program for which the applicant claimed consistency with GALL AMP XI.M32 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff also held onsite interviews with the applicant's personnel to confirm these results.

The staff finds the applicant's One-Time Inspection Program acceptable because it conforms to the recommended GALL AMP XI.M32, One-Time Inspection.

Operating Experience. In LRA B.2.30, the applicant provided the following operating experience evaluation for BVPS:

> The One-Time Inspection Program is a new program; therefore, there is no plant-specific program operating experience for program effectiveness. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description.
>
> Industry and plant-specific experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

The staff reviewed a sample of condition reports that contained mechanical components in environments that the applicant proposed to manage with the One-Time Inspection Program and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. Although the application stated that there is no plant-specific operating experience for program effectiveness because it is a new program, the staff determined that additional information was required to complete its review.

In generic RAI B.2-1, Part 1, dated May 22, 2008, the staff requested that the applicant discuss recently observed material degradation during the implementation of other existing activities that relate to the aging effects that will be managed by the new program and provide the results in the "operating experience" element for that new program. Additionally, the staff requested that the applicant include a commitment to provide operating experience in the future for new programs to confirm their effectiveness, as stated in SRP-LR, Appendix A.1.2.3.10.2.

In its response to Part 1 of RAI B.2-1, dated August 22, 2008, the applicant stated that the One-Time Inspection Program will require one-time inspections to verify effectiveness of the Water Chemistry Program (LRA Section B.2.42), the Fuel Oil Chemistry Program (LRA Section B.2.20), and the Lubricating Oil Analysis Program (LRA Section B.2.24). The applicant further explained that the Water Chemistry Program is an existing sampling and analysis program and that conformance to procedural requirements and industry guidelines, and sensitivity to operating experience reports, provide reasonable assurance that the Water Chemistry Program will effectively manage loss of material, cracking, and reduction of heat transfer for in-scope components during the period of extended operation.

The applicant also stated that the Fuel Oil Chemistry Program is an existing program that utilizes sampling and analysis to ensure that adequate diesel fuel quality is maintained to prevent loss of material and fouling in the various in-scope fuel oil systems. The applicant further stated that exposure of fuel oil to contaminants such as water and particulates is also minimized by periodic draining of accumulated water, tank interior cleaning, and by verifying the quality of new oil before it is introduced into the storage tanks. The applicant added that the Lubricating Oil Analysis Program has been effective at managing aging effects by periodically sampling and analyzing lubricating oil from these in-scope components.

The applicant verified that a search of recent BVPS plant-specific operating experience did not identify any significant aging related degradation associated with the components that will be managed by the One-Time Inspection Program and the Water Chemistry Program (See SER Section 3.0.3.2.14), the Fuel Oil Chemistry Program (See SER Section 3.0.3.2.8), or the Lubricating Oil Analysis Program (See SER Section 3.0.3.1.13). The applicant said that one-time inspections will provide additional assurance that aging does not occur, or aging is so insignificant that an AMP is not warranted. The applicant re-confirmed that the BVPS LRA states that:

> Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

In its response to Part 2 of RAI B.2-1, the applicant amended the LRA to include a new Commitment No. 29 in LRA Table A.4-1 for Unit 1 and Commitment No. 28 in LRA Table A.5-1 for Unit 2, to perform a program self-assessment of all new license renewal AMPs, for completion within five years after entering the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI B.2-1 acceptable because the applicant has verified that the One-Time Inspection Program will be used to determine the effectiveness of the existing AMPs, Water Chemistry Program, Fuel Oil Chemistry Program, and the Lubricating Oil Analysis Program and that the One-Time Inspection Program has the flexibility to incorporate additional operating experience into its requirements. The staff confirms that the applicant has amended the LRA to include a new commitment to validate the effectiveness of the new license renewal AMPs based on the incorporation of operating experience. Therefore, the staff's concerns described in RAI B.2-1 are resolved.

The staff finds the applicant's One-Time Inspection Program acceptable for managing the aging effects for which the program is proposed for in-scope mechanical components. Further, the staff finds that the One-Time Inspection Program will be effective in maintaining the components' intended functions consistent with the CLB for the period of extended operation.

<u>UFSAR Supplement</u>. The applicant provided the UFSAR supplement for the One-Time Inspection Program. The staff verified that the UFSAR supplement summary description for the One-Time Inspection Program conforms to the staff's recommended UFSAR Supplement for these types of programs in SRP-LR Table 3.3.-2. The staff also verified that applicant has committed (Commitment No. 16 in UFSAR Supplement Table A.4-1 and Commitment No. 18 in UFSAR Supplement Table A.5-1) to implement its new One-Time Inspection Program.

Based on this review, the staff finds that UFSAR Supplement Section A.1.30 provides an acceptable UFSAR Supplement summary description of the applicant's One-Time Inspection Program because it is consistent with those UFSAR Supplement summary description in the SRP-LR for One-Time Inspection Program.

<u>Conclusion</u>. The staff finds the applicant's One-Time Inspection Program acceptable because it is consistent with the GALL Report and the plant is bounded by the conditions set forth in the GALL Report for this AMP. Based on its review, the staff concludes that the applicant's One-Time Inspection Program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this

AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.18 One-Time Inspection of ASME Code Class 1 Small Bore Piping Program

Summary of Technical Information in the Application. In LRA Section B.2.31, the applicant described the One-Time Inspection of ASME Code Class 1 Small Bore Piping Program.

The applicant stated that the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program manages the cracking of small bore stainless steel piping less than 4-inches in diameter. This program will involve the use of volumetric inspections on a sample of small-bore butt welds. If evidence is discovered that there is significant aging of small-bore piping during this program, a periodic inspection program will be proposed that will be plant-specific.

The One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program will be implemented within 10 years of the beginning of the period of extended operation.

Staff Evaluation. In the LRA, the applicant stated that the One-Time Inspection of ASME Code Class 1 Small Bore Piping Program is a new program that is consistent with GALL AMP XI.M35, "One-Time Inspection of ASME Class 1 Small Bore Piping."

During its audit, the staff reviewed the applicant's onsite documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL Report.

The staff reviewed those portions of the applicants One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program that the applicant claimed consistency with GALL AMP XI.M35 and found they are consistent with this GALL AMP. The staff also held onsite interviews with the applicant's technical staff to confirm the results.

Based on its review, the staff concluded that the applicant's One-Time Inspection of ASME Code Class 1 Small Bore Piping Program provides assurance that either the aging effect is indeed not occurring, or that the aging effect is occurring very slowly as not to affect the intended function of the component or structure. The staff finds the applicant's One-Time Inspection of ASME Code Class 1 Small Bore Piping Program acceptable because it conforms to the recommended GALL AMP XI.M35.

In RAI B.2.31-1, dated April 3, 2008, the staff requested that the applicant confirm whether there were any socket welds classified as high-safety significant, as part of the risk-informed inservice inspection (ISI) program. The staff noted that these small bore socket welds should be given special significance. The staff also requested that the applicant document how it will handle high-safety significant socket welds.

In its response to RAI B.2.31-1, dated May 5, 2008, the applicant stated that there are six Unit 1 and two Unit 2 ASME Code Class 1 socket welds classified as high-safety significance. There are three two-inch diameter socket welds classified as high-safety significance for seal injection to the RCPs in the CVCS, and three two-inch diameter socket welds in the hot leg of the high-head safety injection supply line at Unit 1. There are two 0.75-inch diameter socket welds on lines that connect to the flow element in the reactor coolant. These socket welds are visually inspected (VT-2) at operating temperature and pressure at each RFO (every 18 months).

The staff noted that it had previously accepted visual inspection of socket welds because there is no approved method for volumetrically inspecting socket welds.

Based on its review, the staff finds the applicant's response to RAI B.2.31-1 acceptable because the applicant has demonstrated that the treatment of these high-safety significant socket welds is adequate. The staff confirms that because there is no accepted method to volumetrically inspect these welds, it has accepted visual inspection of socket welds and notes that any cracks that form in these welds would initiate from the inside diameter, which would be very difficult to detect using a volumetric technique due to the configuration of the socket welds. The staff concludes that a visual inspection at operating temperature and pressure is the only practical method for inspecting these welds. Therefore, the staff's concern described in RAI B.2.31-1 is acceptable.

Operating Experience. The staff also reviewed operating experience, including selected condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. In the LRA, the applicant stated that there is no operating experience for the effectiveness of the One-Time Inspection of ASME Code Class 1 Small Bore Piping Program because it is a new program. The staff determined that additional information was required to complete its review of this program.

In RAI B.2-1, dated May 22, 2008, the staff requested that the applicant provide operating experience information in support of the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program.

In its response to RAI B.2-1, dated August 22, 2008, the applicant stated the following:

> The existing license renewal future commitment for each new aging management program made by FENOC in the BVPS LRA, Appendix A, Table A.4-1 (Unit 1) and Table A.5-1 (Unit 2), as applicable, meets the intent of the recommendation of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," Appendix A, Section A.1.2.3.10.2. For each new program credited by FENOC for aging management during the period of extended operation, a license renewal future commitment is included to implement the program prior to the period of extended operation "as described in" the corresponding Section of Appendix B. The Appendix B Operating Experience element for each new program includes a statement that industry and plant-specific operating experience will be incorporated into the program. Therefore, a license renewal commitment to consider and incorporate feedback from operating experience into new aging management programs is included by reference in the LRA, Appendix A, Tables A.4-1 (Unit 1) and Table A.5-1 (Unit 2). In addition, the FENOC Corrective Action Program is relied upon to document operating experience that indicates a lack of program effectiveness and initiate corrective actions such that recurrence of significant conditions is prevented. These Corrective Action Program activities are applicable to all programs following implementation. However, to confirm the effectiveness of the new

> license renewal aging management programs based on the incorporation of operating experience, the BVPS LRA is revised to include a new license renewal future commitment to perform a program self-assessment of all new license renewal aging management programs, to be completed five (5) years after entering the period of extended operation.

The staff verified that the applicant has committed (Commitments No. 29 on UFSAR Supplement Table A.4-1 for Unit 1 and No. 28 in UFSAR Supplement Table A.5-1 for Unit 2. Therefore, the staff's concern for the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program as described in RAI B.2-1 is resolved.

UFSAR Supplement. In LRA Section A.1.31, the applicant provided the UFSAR supplement for the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program. The staff reviewed this Section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. The staff finds the applicant's One-Time Inspection of ASME Code Class 1 Small Bore Piping Program acceptable because it is consistent with the GALL Report and the plant is bounded by the conditions set forth in the GALL Report for this AMP. Based on its review, the staff finds that the program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.19 Open-Cycle Cooling Water System Program

Summary of Technical Information in the Application. In LRA Section B.2.32, the applicant described the existing Open-Cycle Cooling Water System Program as consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System."

The Open-Cycle Cooling Water System Program implements commitments to GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment," including Supplement 1. This program manages the aging effects on the open-cycle cooling water systems (CWSs) to ensure that the systems will perform intended functions during the period of extended operation. The program has surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the river water (Unit 1) and service water (Unit 2) systems or SCs serviced by the systems.

Staff Evaluation. In LRA Section B.2.32, the applicant stated that the Open-Cycle Cooing Water System Program is an existing program that is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System," with enhancements and exceptions.

The staff reviewed those portions of the applicant's Open-Cycle Cooling Water System Program that the applicant claimed consistency with GALL AMP XI.M20 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant's technical personnel to confirm these results.

As a result of the staff's IP-71002 inspections during the weeks of June 23 and July 14, 2008, the applicant identified revisions to the LRA which include new program exceptions and enhancements. The applicant provided the program changes in its letter (L-08-262) to the staff, dated September 9, 2008, which includes LRA Amendment No. 23. The staff's review of the enhancements and exceptions to this AMP that the applicant has taken against the program elements in GALL AMP XI.M20 are evaluated in the subsections that follow.

Enhancements. In letter L-08-262, Amendment No. 23, dated September 9, 2008, the applicant identifies the following enhancements to the "Scope of Program" and "Detection of Aging Effects" elements.

(1) The "Scope of Program" will be expanded to include a Unit 1 post-accident sampling system heat exchanger (PAS-E-1) credited with a leakage boundary function.

(2) The "Detection of Aging Effects" describe that the internal condition of buried piping will be assessed by opportunistic inspections of header piping internals during removal of expansion joints and inline valves in the headers. Evaluation of inspection results will be documented and trended.

The staff reviewed the applicant's program enhancements and compared the changes with the GALL AMP XI.M20 recommendations for the enhanced elements. The staff verified that the applicant has incorporated these enhancements to the Open-Cycle Cooling Water System Program in Commitment No. 30 of UFSAR Supplement Table A.4-1 for Unit 1 and in Commitment No. 31 of UFSAR Supplement Table A.5-1 for Unit 2.

The staff finds the applicant's Open-Cycle Cooling Water System Program acceptable because it conforms to the recommended GALL AMP XI.M20. and notes that implementation of these enhancements and commitments will make the applicant's Open-Cycle Cooling Water Systems consistent with the GALL AMP XI.M20.
Based on its review, the staff finds the applicant's enhancements to the Open-Cycle Cooling Water System Program acceptable because they will make the "scope of program" and "detection of aging effects" program elements of the AMP consistent with the staff's recommendations in the "scope of program" and "detection of aging effects" program elements in GALL AMP XI.M20.

Exception. In letter L-08-262, Amendment No. 23, dated September 9, 2008, the applicant identifies the following exception to the "Preventive Actions" element:

> River Water / Service Water lines supplying backup water sources to the Auxiliary Feedwater Systems and to the Spent Fuel Pools will not be periodically flushed. It is undesirable to contaminate the Auxiliary Feedwater System and Spent Fuel Pool with raw water, and the configuration of these piping sections precludes concerns for silt and sediment buildup.

The staff noted that the "preventive actions" program element in GALL AMP XI.M20 recommends periodic flushing of open-cycle CWSs (*e.g.*, uncontrolled raw water or SWSs), if the systems are infrequently used.

The staff reviewed the license renewal drawings and design documents for the river water and service water systems and noted that these systems are normally in service during plant power operations, plant shutdowns, and operations during anticipated operational transients.

Based on its review, the staff finds the applicant's exception to the recommendation in GALL AMP XI.M20 acceptable because: (a) the applicant has explained that periodic flushing of the backup river water and service water supply lines to the AFW and SFP systems from the river water and SWSs within the Open-Cycle Cooling Water Program would contaminate the aforementioned systems, due to their design configurations; (b) the river water and service water systems are generally in service, and the design flows in these systems will minimize the occurrence of silting and sediment in the systems during plant operations; (c) the applicant implements the addition of biocides to the raw water in order to preclude biological organisms from growing in these raw water systems and; (d) the applicant implements the remaining recommendations of GL 89-13 for these systems.

The staff further finds that the applicant's program elements provide an acceptable basis for managing loss of material, loss of heat transfer function and cracking in the systems containing uncontrolled raw water because the staff has verified that, with the exception taken on performing periodic flushing of the systems, the program elements for the AMP are consistent with the program element criteria recommended in GALL AMP XI.M20. The staff also finds that the applicant has provided a valid basis for concluding that the recommendation for periodic flushing of the systems in GALL AMP XI.M20 need not be implemented. Therefore, the staff concludes that the applicant's enhancements of the Open-Cycle Cooling Water Program to include the Unit 1 post-accident sampling system heat exchanger (PAS-E-1) within the scope of the AMP and update of the program to describe that the internal condition of buried piping will be assessed by opportunistic inspections of header piping internals, during removal activities for expansion joints and inline raw water header valves, are acceptable because the enhancements will make the program elements for this AMP consistent with GALL AMP XI.M20.

Operating Experience. In LRA AMP B.2.32, the applicant provided the following operating experience evaluation for BVPS:

> Microbiologically influenced corrosion (MIC) and macro-fouling have occurred on occasion at BVPS within the River and Service Water systems and other heat exchangers which reject heat directly to the river. Those systems using water from the Ohio River as a heat sink are collectively referred to as the Open Cycle Cooling Water (OCCW) system.
>
> MIC can result in pipe and component wall thinning, which if left unchecked, can cause failure of the affected component. Macro-fouling and MIC also produce silting, which can lead to a decrease in system flow and a subsequent reduction in heat removal. The OCCW program is designed for timely identification of the symptoms of MIC and macro-fouling which will allow corrective actions, such as cleaning, chemical addition, or component replacement, to be taken.
>
> Quality Assurance audits of the OCCW and river water chemistry control programs evaluate the BVPS compliance with NRC guidance (Generic Letter 89-13) for MIC and macro-fouling control within OCCW system components. The most recent audit was completed in December of 2004, the result of which

revealed that BVPS satisfies staff and industry guidelines for OCCW system chemistry control and regulation of MIC and macro-fouling. However, areas for improvement were identified and documented within the Corrective Action Program. The audit showed that a sufficient number of parameters are measured to detect abnormal conditions which could be indicative of MIC, macro-fouling, or silting. Biocide concentrations were maintained within specified bands, and associated systems were found to be treated and controlled to acceptable levels consistent with industry and NRC guidelines. Adherence to recommended chemistry specifications and regular monitoring of key system flow parameters provide reasonable assurance that the OCCW program will effectively manage loss of material and reduction of heat transfer for in-scope OCCW components.

The OCCW system program at BVPS satisfies GL 89-13 commitments for managing aging effects due to biofouling, corrosion, protective coating failures, and silting within system components. In October, 2004, an NRC audit was conducted on the implementation of Generic Letter, GL 89-13. The audit did not reveal any findings, however, suggested improvements were identified to further strengthen the OCCW system program. For example, a recommendation was made to increase the inspection and cleaning frequencies of OCCW system components which would allow the program to sooner identify a component in the early stages of material loss. The recommended improvement, to modify the monitoring program administrative procedure, was documented within the Corrective Action Program and incorporated into the program.

Thermal Performance Testing of River/Service water cooled heat exchangers, a Generic Letter 89-13 requirement, also provides valuable data on the internal condition of OCCW components. The 2005 Ultimate Heat Sink Biennial Inspection, which included evaluation of the Thermal Performance Testing program, was completed in December with no findings. As part of this inspection, BVPS completed three thermal performance tests on River/Service Water cooled heat exchangers. Specifically, the Unit 1 and Unit 2 charging pump lube oil coolers and Unit 1 diesel generator jacket water cooler were evaluated. All heat exchanger thermal performance test results were satisfactory.

An important element of OCCW system program evaluation is benchmarking trips to other facilities to assess comparable systems and learn from and apply actions which may be applicable to BVPS. Such a trip was taken to the North Anna Station in 2002, which was documented in the Corrective Action Program. Valuable examples of operating experience were identified and evaluated for applicability at BVPS using the Corrective Action Program. Specific examples include use of more accurate flow measuring instrumentation to assess performance changes within the River/Service Water systems, and a program in which large-bore pipes and heat exchanger end bells are hydro-lazed and lined with an epoxy resin.
Program audits, thermal performance testing, and benchmarking other facilities provide reasonable assurance that the OCCW program will effectively manage loss of material and reduction of heat transfer for in-scope OCCW components.

The staff reviewed the operating experience provided by the applicant in the LRA and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff noted that the applicant's Open-Cycle Cooling Water Program is periodically evaluated and enhanced to include industry experience and plant-specific experience. The staff confirms that the applicant has evaluated applicable aging effects and industry and plant-specific operating experience and has addressed the generic and plant-specific operating experience related to raw water system fouling. The staff further confirms that the applicant is implementing its commitments in response to GL 89-13 and the generic operating experience discussed therein.

Based on its assessment, the staff finds that the applicant's Open-Cycle Cooling Water System Program has been effective and will continue to be effective in monitoring, controlling, and correcting the aging effects of components within the scope of this program because the applicant incorporates the results of relevant operating experience into the scope of AMP and adjusts the program elements in accordance with this operating experience, and because the applicant has implemented and will continue to implement its commitments made in response to GL 89-13, during the period of extended operation.

UFSAR Supplement. In LRA Section A.1.32, the applicant provided the UFSAR supplement for the Open-Cycle Cooling Water System Program. The staff reviewed this Section and determines that the information provided by the applicant in the UFSAR Supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff confirms that the applicant has provided the program changes in letter L-08-262, Amendment No. 23, dated September 8, 2008, which includes the addition of the new enhancements to LRA Table A.4-1 (Commitment No. 30 for Unit 1) and LRA Table A.5-1 (Commitment No. 31 for Unit 2).

Conclusion. The staff finds the applicant's Open-Cycle Cooling Water System Program acceptable because it is consistent with the GALL Report and the plant is bounded by the conditions set forth in the GALL Report for this AMP. Based on its review, the staff finds that the Open-Cycle Cooling Water System Program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.20 PWR Vessel Internals Program

Summary of Technical Information in the Application. In LRA Section B.2.33, the applicant described the PWR Vessel Internals Program as a new condition monitoring program designed to manage the effects of aging in RV internals components for the Units 1 and 2.

Staff Evaluation. The staff noted that the GALL Report does not have a recommended AMP (other than perhaps the Water Chemistry Program or the ASME Section XI, Subsection IWB, IWC, and IWD Program) for the management of postulated aging effects that may potentially occur in the RV internals of PWR-designed reactors. Instead, the staff has provided the following statement in the AMP program columns of AMRs in GALL Report

Tables IV.B2, IV.B3, and IV.B4 that credit plant-specific activities for management of RV internals components for PWRs:

> No further aging management review is necessary if the applicant provides a commitment in the UFSAR supplement to (1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval.

This approach to aging management conforms to the staff's recommended aging management guidelines provided in the following sections of the SRP-LR:

- Section 3.1.2.2.6 – Loss of Fracture Toughness due to Neutron Irradaition Embrittlement and Void Swelling
- Section 3.1.2.2.9 – Loss of Preload due to Stress Relaxation
- Section 3.1.2.2.12 – Cracking due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking (IASCC)
- Section 3.1.2.2.15 – Changes in Dimensions due to Void Swelling
- Section 3.1.2.2.17 – Cracking due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking (IASCC)

The following examination categories ASME Code Section XI, Table IWB-2500-1,"Examination Categories," also may be applicable as condition monitoring programs for RV internals components in PWRs, dependant upon whether an applicant's RV design includes these type of internal component commodity groups, and an applicant has included these examination categories within the scope of its PWR Vessel Internals Program or its ASME Section XI, Subsection IWB, IWC, and IWD Program:

- B-N-1 – Interior of the Reactor Vessel
- B-N-2 – Integrally Welded Core Support Structures and Interior Attachments to Reactor Vessel
- B-N-3 – Removable Core Support Structures

The applicant's PWR Vessel Internals Program is the AMP that incorporates the commitment recommended in the GALL Report Table IV.B2 for the majority of the RV internals components in Westinghouse designed PWRs. The staff reviewed the information that the applicant provided in the LRA Section B.2.33, the applicant's license renewal basis document for this AMP, and other supporting information and documents that pertain to the applicant's procedural and implementation controls for this AMP.
The staff reviewed this information against the regulatory criteria summarized above.

The staff noted that in LRA Table 3.1.2-2, the applicant credits its PWR Vessel Internals Program as the basis for managing applicable aging effects for a significant number of RV internals component commodity groups at Units 1 and 2. The staff also noted that the applicant has committed (Commitment No. 18 in LRA Table A.4-1 for Unit 1 and Commitment No. 20 in

LRA Table A.5-1 for Unit 2) to implementing the following actions and activities for the RV internals that are managed in accordance with its PWR Vessel Internals Program:

> Commitment No. 18 for Unit 1:
>
> For the PWR Vessel Internals Program, regarding activities for managing the aging of Reactor Vessel internal components and structures, BVPS commits to: 1. Participate in the industry programs applicable to BVPS Unit 1 for investigating and managing aging effects on reactor internals; 2. Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1 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 the BVPS Unit 1 reactor internals to the NRC for review and approval.
>
> Commitment No. 20 for Unit 2:
>
> For the PWR Vessel Internals Program, regarding activities for managing the aging of Reactor Vessel internal components and structures, BVPS commits to: 1. Participate in the industry programs applicable to BVPS Unit 2 for investigating and managing aging effects on reactor internals; 2. Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 2 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 the BVPS Unit 2 reactor internals to the NRC for review and approval.

The staff verified that the provisions in Commitments No. 18 for Unit 1 and No. 20 for Unit 2 conform to the commitment criteria recommendations discussed above. The staff also verified that in LRA Table A.4-1, the applicant has scheduled to implement Commitment No. 18 for Unit 1 by January 29, 2014, and Commitment No. 20 for Unit 2, by May 27, 2025. The operating license for Unit 1 will expire on January 29, 2016, according to Operating License No. DPR-66, Clause 2.F. The operating license for Unit 2 will expire on May 27, 2027, according to Operating License No. NPF-73, Clause 2.I. Based on this information, the staff also verified that the applicant's implementation milestones for these commitments conform with the staff's recommendation that licensee's submit inspection plans for the RV internals for staff review and approval at least two years prior to entering the period of extended operation.

Although the staff verified that the applicant's commitments for aging management of its RV internals were consistent with the guidance in the SRP-LR and the GALL Report, the staff determined that additional information was required to complete its review, specifically noting that discrepancies remained between the AMR items for these components and the applicant's commitments to ensure adequate aging management of the components. The staff further noted that the applicant's PWR Vessel Internals Program does not have a specific corresponding program in the GALL Report Volume 2, Chapter XI and that if the applicant intended on tying the basis for aging management to its PWR Vessel Internals Program, then the AMP should be defined as plant-specific in the LRA.

In RAI B.2.33-1, dated June 5, 2008, the staff requested that the applicant justify why the PWR Vessel Internals Program had not been identified as a plant-specific AMP in the LRA and the program elements for this AMP omitted from the application.

In its response to RAI B.2.33-1, dated July 21, 2008, the applicant stated that the intent of LRA Section B.2.33 was not to define an AMP with 10 elements. The applicant confirmed that the intent of LRA Section B.2.33 was to identify a commitment, as specified in the GALL Report and stated that the commitment wording was included in LRA Appendix B as a pointer and for ease of review. The applicant clarified the issue and revised LRA Sections A.1.33 and B.2.33 to delete the misleading text, further stating that other sections of the LRA are also revised to delete references to the AMP, and to include references to the commitments (Commitment No. 18 and Commitment No. 20) provided in LRA Tables A.4-1 (Unit 1) A.5-1 (Unit 2), respectively. The staff reviewed the applicant's response and verified that the applicant has amended the LRA as noted above. The staff noted that the amendments are consistent with Westinghouse-designed RV internals components found in the GALL Report, Table IV.B2. Based on its review, the staff finds the applicant's response to RAI B.2.33-1 acceptable because the applicant has amended the AMRs on management of cracking, loss of fracture toughness, changes in dimension, and loss of preload of the RV internals components for Units 1 and 2 to be consistent with their corresponding AMRs in the GALL Report, Table IV.B2. The staff further finds that the applicant has committed (Commitments No. 18 and No. 20) to develop a plant-specific PWR Vessel Internals Monitoring AMP that will implement activities from industry investigations (including operating experience), as applicable to BVPS, for managing aging effects on reactor internals, prior to the period of extended operation. Therefore, the staff's concern described in RAI B.2.33-1 is resolved.

The staff also noted that in the GALL Report, Table IV.B2, the staff recommends that the type of commitment discussed in the Staff Evaluation be credited for aging management of the RV internals in Westinghouse-designed PWRs. The staff reviewed the technical and regulatory information in the applicant's PWR Vessel Internals Program. The staff noted that although the applicant had provided the appropriate commitment (Commitments No. 18 in LRA Table A.4-1 for Unit 1 and No. 20 in LRA Table A.5-1 for Unit 2) for its RV internals components, the applicant did not identify which RV internals components commodity at Units 1 and 2 were within the scope of the PWR Vessel Internals Program and the regulatory commitments.

In RAI B.2.33-2, dated June 5, 2008, the staff requested that the applicant clarify which PWR RV internals components at Units 1 and 2 are within the scope of the PWR Vessel Internals Program and LRA Commitments No. 18 for Unit 1 and No. 20 for Unit 2.

In its response to RAI B.2.33-2, dated July 21, 2008, the applicant stated that, consistent with its response to RAI-B.2.33-1, it has amended LRA B.2.33 and A.1.33 to delete the misleading text.

Additionally, the applicant has updated AMR items in LRA Table 3.1.2-2 to delete the reference to the PWR Vessel Internals Program, in favor of references to its commitments provided for the components in LRA Tables A.4-1 and A.5-1 (Commitments No. 18 for Unit 1, and No. 20 for Unit 2).

The applicant clarified that the components now managed in the AMRs by these commitments are as follows:

- Core baffle/former assembly bolts and plates
- Core barrel shells, rings, flanges, nozzles, and thermal shields and pads
- Core barrel assembly bolts
- Instrumentation support structure flux thimble guide tubes and thermocouple conduits
- Lower internals assembly clevis inserts and clevis insert bolts
- Lower internals assembly core support forgings and lower support columns
- Lower internals assembly lower core plates, support column bolts, fuel alignment pins, radial keys
- Lower internals assembly secondary core supports, head/vessel alignment pins, and head cooling spray nozzles
- Lower internals assembly Unit 1 diffuser plate and Unit 1 lower support column casting
- RCCA guide tube assembly bolts, guide tubes and support pins
- Upper internals assembly core plate alignment pins, fuel alignment pins, hold-down springs, support column mixer bases, and support columns
- Upper internals assembly upper core plates, upper support plates, support assemblies and support column bolts

The staff noted that list of components above is consistent with the list of components in GALL Report, Table IV.B2, for which these types of commitments are credited for aging management.

Based on its review, the staff finds the applicant's response to RAI B.2.33-2 acceptable because the applicant has appropriately identified the RV internals components that are within the scope of Commitment No. 18 for Unit 1 and Commitment No. 20 for Unit 2, and because the applicant's list of components is consistent with those in the GALL Report, Table IV.B2, for which these commitments are credited. Therefore, the staff's concern described in RAI B.2.33-2 is resolved.

In RAI B.2.33-3, dated June 5, 2008, the staff requested that the applicant clarify whether or not the examination requirements in ASME Code Section XI, Examination Categories B-N-1, B-N-2, or B-N-3 are applicable to the RV internals components at Units 1 and 2 and if so, whether the applicant is crediting the applicable examination category requirements for aging management either under the ASME Section XI, Subsection IWB, IWB, and IWD Program or the PWR Vessel Internals Program.

In its response to RAI B.2.33-3, dated July 21, 2008, the applicant identified the following ISIs of the RV internals at Units 1 and 2, as required by 10 CFR 50.55a and the ASME Code Section XI:

- Inspections of the interior of the reactor vessels (RVs) – Examination Category B-N-1
- Inspections of the integrally welded core support structures and interior attachments to the RV – Examination Category B-N-2
- Inspections of removable core support structures Examination Category B-N-3

The applicant clarified that the inspections performed under these examination categories are scheduled and performed in accordance with the ASME Boiler and Pressure Vessel Code, Section XI, Table IWB-2500-1, under the BVPS ASME Section XI, Inservice Inspection Program, subject to the limitations and modifications of 10 CFR 50.55a. The applicant stated that, consistent with the recommendations in the GALL Report, Items IV.B2-26 and IV.B2-34, only three AMRs for RV internals components in LRA Table 3.1.2-2 credit the ASME Code Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program (LRA Section B.2.2) for aging management. The applicant further clarified that the RV internals components within the scope of these ASME Section XI inspections are the clevis inserts, core plate alignment pins, and radial keys, located in the RV lower internal assembly. The applicant stated that inservice inspections for these components are implemented as part of the applicant's AMSE Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program. The applicant also clarified that the inservice inspections of these components are not within the scope of the commitments for the RV internals because the commitments cover the augmented inspection activities that will be implemented for the RV internals, which go beyond the inservice inspections required by the ASME Code Section XI examination categories.

The staff noted that the applicant's commitments (Commitments No. 18 in LRA Table A.4-1 for Unit 1 and No. 20 in LRA Table A.5-1 for Unit 2) for the RV internals pertain to the development of an augmented inspection for the RV internals. These commitments are based on industry initiatives of the EPRI MRP task group on RV internals component degradation and goes beyond the required inservice inspections pursuant to ASME Code Section XI, Examination Categories B-N-1, B-N-2, and B-N-3.

Based on its review, the staff finds the applicant's response to RAI B.2.33-3 acceptable because the applicant has clarified that the required ASME Code Section XI inservice inspections for the RV internals are applicable to the clevis inserts, core plate alignment pins, and radial keys located in the RV lower internal assembly and that these ISIs are implemented as part of the applicant's AMSE Code Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program. Therefore, the staff's concern described in RAI B.2.33-3 is resolved.

Based on the staff's review, and the applicant's resolution of RAIs B.2.33-1, -2, and -3, the staff concludes that the applicant's commitments (Commitments No. 18 for Unit 1 and No. 20 for Unit 2) are acceptable for aging management because these commitments conform to the staff's commitment criteria specified in the GALL Report, Volume 2, Table IV.B2. Additionally, the staff concludes that the applicant's implementation schedule for these commitments conforms to the staff's commitment recommendation that the applicant submit inspection plans for the RV internals to the staff for review and approval at least two years prior to entering the period of extended operation.

Since the staff has accepted the applicant's basis for deleting this AMP from the LRA, the staff finds that there is no reason to perform a program element evaluation of the PWR Vessel Internals Program that was originally docketed in the LRA.

Operating Experience. The applicant's PWR Vessel Internals Program is a new program that will be implemented at least two years prior to entering the period of extended operation. As such, there is no relevant operating experience, to date, because the AMP has yet to be implemented. In SRP-LR Section A.1.2.310, Item 2, the staff states that an "applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness."

In RAI B.2-1, dated May 22, 2008, the staff requested that the applicant make a commitment for the new programs in order to bring these AMPs into conformance with the guidance for new AMPs found in staff's "operating experience" criterion in SRP-LR Section A.1.2.310.

In its response to RAI B.2-1, dated August 22, 2008, the applicant clarified that the existing license renewal future commitment for each new aging management program made by FENOC in LRA, Appendix A, Table A.4-1 (Unit 1) and Table A.5-1 (Unit 2), as applicable, meets the intent of the recommendation of SRP-LR Section A.1.2.3.10.2. The applicant further clarified that, for each new program credited by FENOC for aging management during the period of extended operation, a license renewal future commitment is included to implement the program prior to the period of extended operation, as described in the corresponding Section of LRA Appendix B, and that the "operating experience" program element for each new program includes a statement that relevant industry and plant-specific operating experience will be incorporated into the program.

The applicant also clarified that a license renewal commitment to consider and incorporate feedback from operating experience into new AMPs is included in LRA Tables A.4-1 (Unit 1) and Table A.5-1 (Unit 2). Also, the applicant clarified that the FENOC Corrective Action Program is relied upon to document any operating experience that indicates a lack of program effectiveness and to initiate corrective actions such that recurrence of significant conditions is prevented. The applicant clarified that the Corrective Action Program activities are applicable to all programs following implementation. However, to confirm the effectiveness of the new license renewal AMPs based on the incorporation of operating experience, the applicant amended the LRA for BVPS to include a new license renewal future commitment to complete a program self-assessment of all new license renewal AMPs within five years after entering the period of extended operation. The staff verified that the applicant has incorporated this commitment for new programs in its August 22, 2008, response to staff.

Based on its review, the staff finds the applicant's response to RAI B.2-1 acceptable because the applicant has: (a) committed to develop an inspection plan and program for these internal components and to submit them for staff review and approval at least two years prior to entering the period of extended operation; (b) committed to implement this program during the period of extended operation; and (c) placed a commitment on the program to incorporate the lessons learned from any relevant operating experience that results from the inspections of the RV internals components for Units 1 and 2. Therefore, the staff's concern described in RAI B.2-1 is resolved.

UFSAR Supplement. The applicant provided a UFSAR supplement of its PWR Vessel Internals Program in LRA Section A.1.33. The staff verified that the applicant has provided an acceptable summary description of commitments that have been credited for aging management of the RV internals for Units 1 and 2.

These commitments have been identified in the Staff Evaluation section. The staff also verified that the applicant has included the commitments (Commitments No. 18 and No.20) in LRA Tables A.4-1 and A.5-1 for Unit 1 and Unit 2, respectively.

In RAI B.2-1, the staff requested that the applicant commit in the LRA to provide future operating experience for new AMPs in order to confirm their effectiveness and to bring the applicant's "operating experience" program element for new AMPs into conformance with the "operating experience" program element criterion in SRP-LR Section A.1.2.310, Item 2. This RAI is relevant to the staff's approval of the applicant's UFSAR supplement for the PWR Vessel Internals Program because this is a new program that has not been approved by the staff and implemented at the BVPS facility.

In RAI B.2.33-2, the staff requested that the applicant clarify which PWR RV internals components at Units 1 and 2 are within the scope of the applicant's PWR Internals Program and LRA Commitments No. 18 for Unit 1 and No. 20 for Unit 2. This RAI is relevant to the staff's approval of the applicant's UFSAR supplement for the PWR Vessel Internals Program because the staff's approval of this program depends on the RV internals components that the applicant has identified as being within the scope of program.

As discussed in the Staff Evaluation Section above, the staff determined that the applicant has provided an acceptable basis for resolving RAIs B.2-1 and B.2.33-2 because the applicant has identified those RV internals components within the scope of Commitment No. 18 (LRA Table A.4-1 for Unit 1) and Commitment No. 20 (LRA Table A.5-1 for Unit 2) and has amended the LRA to include a commitment that after the plan and program has been developed, approved by the staff, and implemented, the applicant will incorporate any lessons learned from the relevant operating experience resulting from the inspections of the RV internals components at Units 1 and 2.

Based on its review, the staff finds that the UFSAR supplement is acceptable because it includes Commitments No. 18 (LRA Table A.4-1) and No. 20 (LRA Table A.5-1), and a new commitment to incorporate lesson learned from future operating experience into the RV internals inspection plan. The staff further finds that the applicant's PWR Internals Inspection Program will be developed, approved by the staff, and implemented during the period of extended operation.

<u>Conclusion</u>. Based on its review of the applicant's PWR Vessel Internals Program, the staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.21 Steam Generator Tube Integrity Program

<u>Summary of Technical Information in the Application</u>. In LRA Section B.2.38, the applicant described the existing Steam Generator Tube Integrity Program as consistent with GALL AMP XI.M19, "Steam Generator Tube Integrity."

The applicant stated that the Steam Generator Tube Integrity Program is based on NEI 97-06, "Steam Generator Program Guidelines." The applicant credits the Steam Generator Tube Integrity Program for aging management of the tubes, tube plugs, tube supports, and the secondary-side internal components failure of which could prevent the SG from performing its intended safety function. The program has performance criteria for assurance of SG tube integrity maintenance consistent with the CLB and guides monitoring and tube maintenance for assurance that performance criteria is met at all times between scheduled tube inspections.

The applicant also stated that the Steam Generator Tube Integrity Program inspections detect flaws in tubes, plugs, tube supports, and secondary-side internal components needed to maintain tube integrity. Degradation assessments detect both potential and actual degradation mechanisms. ISIs (*i.e.*, eddy current testing, UT, and visual inspections) detect flaws. Condition monitoring compares the inspection results against performance criteria, and an operational assessment predicts tube conditions so performance criteria will not be exceeded during the next operating cycle. The program continually monitors primary to secondary leakage during operation.

Staff Evaluation. In LRA Section B.2.38, the applicant stated that the Steam Generator Tube Integrity Program is an existing program that is consistent with GALL AMP XI.M19.

The staff reviewed those portions of the applicant's Steam Generator Tube Integrity Program that the applicant claimed consistency with GALL AMP XI.M19 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff reviewed the applicant's Program Evaluation Document and confirmed that the program scope includes all in-scope mechanical components whose failure could prevent the SG from fulfilling its intended safety function (*i.e.*, tubes, tube plugs, tube supports, and the secondary-side internal components). The staff conducted onsite interviews with the applicant's technical personnel to confirm these results. The staff finds the applicant's Steam Generator Tube Integrity Program acceptable because it conforms to the recommended GALL AMP XI.M19.

Operating Experience. In LRA AMP B.2.38, the applicant provided the following operating experience evaluation for BVPS:

> BVPS Unit 1 steam generators (SGs) were replaced during the Unit 1 Cycle 17 Refueling Outage (February - April 2006), and the plant achieved full, uprated core thermal power in January of 2007. BVPS Unit 2 continues to operate with its original steam generators and has partially uprated its core thermal power output. Unit 2 is expected to achieve its full, uprated power after future plant modifications.
>
> During each refueling outage, SG degradation assessments are performed in accordance with the provisions of NEI 97-06 and Section 5.2 of the EPRI PWR SG examination guidelines. These industry guidelines are based in part on operating experience and inspection results from other operating PWRs. Incorporation of plant and industry operating experience and use of industry guidance documents in the development of an inspection program provide assurance that the SG tube integrity program will continue to effectively manage aging effects of these passive components. Results of recent degradation assessments performed during the Unit 1 Cycle 16 Refueling Outage (October - November 2004) and the Unit 2 Cycle 11 Refueling Outage (April 2005) are summarized in SG degradation assessment reports. Topics covered in the reports include SG tube degradation mechanisms, inspection & expansion

requirements, tube repair criteria, structural limits, guidelines for testing, and chemical cleaning provisions. As a result of the Unit 1 Cycle 16 Refueling Outage inspections at Unit 1, 196 SG tubes were plugged. As with all previous inspections, the condition of the Unit 1 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 outcome of the Unit 2 Cycle 11 Refueling Outage SG inspections necessitated that 55 tubes be plugged. The condition of the three SGs (with the degraded tubes plugged) met industry and regulatory structural and leakage integrity guidance, and the SGs were expected to meet these criteria following the outage inspection. The degradation assessments also include discussions of specific and recent industry events (Section 4.7 of the Unit 1 Cycle 16 Refueling Outage report and Section 3.7 of the Unit 2 Cycle 11 Refueling Outage report). For example, lessons learned from false indications of eddy current testing at the Comanche Peak station resulted in changes to the BVPS bobbin analysis method. At the Shearon Harris plant, low level primary-to-secondary leakage was determined to be caused by foreign object wear just above the top of the cold leg side of the tubesheet. The inspection of the affected tube during the previous outage did not identify any flaw, however, subsequent manual reanalysis of the data suggested that flaw was present when the affected tube was tested. The failure to identify the flaw in the affected tube was attributed to a "sorting logic" gap that resulted in ½ inch Section of tube which was not analyzed. The flaw was located within this unanalyzed ½ inch Section of tube. As a result of this event, BVPS evaluated the sorting logic to verify that the logic did not contain similar gaps. Using the accepted industry approach to testing and evaluation, and incorporation of pertinent industry operating experience, insures that the steam generator tube integrity program manages the effects of component aging such that the steam generators will continue to perform their intended functions, consistent with the CLB, during the period of extended operation.

The staff reviewed the applicant’s operating experience provided in the LRA and interviewed the applicant’s technical personnel to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff also confirmed that applicable aging effects and industry and plant-specific operating experience have been evaluated and incorporated into the Steam Generator Tube Integrity Program for BVPS. The applicant used an example of industry operating experience to alter the BVPS Program that included changing the bobbin analysis method due to false indications experienced at Comanche Peak.

The staff noted that the applicant’s program is implemented through plant-specific procedures that have requirements for assessing tube integrity. The assessment activities include periodic verification of SG tubing, tube sleeve and tube plug integrity by volumetric and visual examination methods and secondary side components. The staff also noted that the requirements for SG inspection scope, frequency, and acceptance criteria for plugging and repair of flawed tubes are specified in BVPS Technical Specifications.

Additionally, the applicant’s program procedures specify requirements for water chemistry, control of foreign material, industry assessment, self assessment, and required reporting (*i.e.*, GL 97-06 for secondary side internals degradation).

In accordance with technical specifications, the program procedures detect flaws in tubing, plugs, and sleeves, or degradation of secondary side internals. The applicant's program utilizes industry established nondestructive examination techniques to identify tubes that are defective and need to be removed from service or repaired. These requirements are established by BVPS technical specifications. The applicant's program provides reasonable assurance that SG tube integrity is maintained consistent with the plant's licensing basis for extended operation because it requires assessments of degradation that occurred between RFOs and that reports of the assessment results are incorporated into plant and industry experience documents.

The topics covered by the reports include SG tube degradation mechanisms, inspection and expansion requirements, tube repair criteria, structural limits, guidelines for testing, and chemical cleaning provisions.

Based on its review, the staff finds that the applicant's Steam Generator Tube Integrity Program has been effective in monitoring, detecting flaws, and implementing repairs to correct the aging effects of components within the scope of this program such that they will continue to perform their intended functions consistent with the CLB for the period of extended operation.

UFSAR Supplement. In LRA Section A1.38, the applicant provided the UFSAR supplement for the Steam Generator Tube Integrity Program. The staff reviewed this Section and determines that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d), and is consistent with the guidance provided in the SRP-LR Table 3.1-2.

Conclusion. The staff reviewed the information provided by the applicant in LRA Section B.2.38. Based on its review, the staff finds the applicant's Steam Generator Tube Integrity Program acceptable because it is consistent with the GALL Report and the plant is bounded by the conditions set forth in the GALL Report for this AMP. The staff finds that the program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.22 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

Summary of Technical Information in the Application. In LRA Section B.2.40, the applicant described the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program as a new monitoring program designed to manage reduction of (loss of) fracture toughness in CASS RV internals components. The applicant stated that the program elements for this AMP are consistent with the program element criteria recommended in GALL AMP XI.13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)," without exception or enhancement.

Staff Evaluation. The staff's aging management recommendations and program element criteria for Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Programs are documented in GALL AMP XI.M13. In the GALL Report, the staff established its position that a supplemental flaw tolerance assessment, volumetric examination techniques, or enhanced VT-1 visual inspection techniques should be credited to manage reduction of fracture toughness due to thermal aging embrittlement or neutron irradiation embrittlement in CASS RV internals components.

Further staff guidance (NRC letter dated May 19, 2000) provides additional criteria for establishing whether a particular CASS material is susceptible to thermal aging embrittlement and describes aging management strategies for these materials. The guidance found in GALL AMP XI.M13, references the additional criteria and aging management strategies documented in the May 19, 2000 NRC letter.

The staff reviewed the applicant's information provided in LRA Section B.2.40 and supporting BVPS-specific documents, against the regulatory criteria discussed above.

The staff noted that the applicant's program elements for this AMP were consistent with the program element criteria recommended in GALL AMP XI.M13, with one exception. The staff determined that additional information was required to complete its review.

In RAIs B.2.40-1 and B.2.41-1, dated June 5, 2008, the staff requested that the applicant clarify whether the current state-of-the-art UT techniques are capable of detecting either surface penetrating cracks or subsurface cracks in CASS RV internals components and whether these UT examination methods have been qualified for CASS materials.

In its response to RAIs B.2.40-1 and B.2.41-1, dated July 21, 2008, the applicant stated that it is amending the LRA to delete LRA AMP B.2.40 "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)," and UFSAR supplement Section A.1.40, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program." The applicant also stated that it is amending LRA Table 3.1.2-2 that referred to the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program to change the AMP for RV internals components. The applicant will instead credit the commitments (Commitments No. 18 and 20 in UFSAR Supplement Tables A.4-1 and A.5-1 for Units 1 and 2, respectively) for managing cracking, loss of preload, changes in dimension and loss of fracture toughness in the RV internals components, as its basis for aging management. The applicant made the following commitments to manage the aging effects in the RV internals components:

> Regarding activities for managing the aging of Reactor Vessel internal components and structures, BVPS commits to:
>
> (1) Participate in the industry programs applicable to BVPS for investigating and managing aging effects on reactor internals;
>
> (2) Evaluate and implement the results of the industry programs as applicable to the BVPS 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 the BVPS reactor internals to the NRC for review and approval.

The staff verified that the applicant has amended the LRA to include a commitment to manage the aging effects in the RV internals components. The staff's evaluation and basis for accepting the applicant's commitments for managing loss of fracture toughness of CASS RV internals components resulting from neutron irradiation embrittlement and thermal aging is found in SER Sections 3.1.2.1.2 and 3.0.3.3.3. In these SER sections, the staff provides the basis for concluding that the applicant's commitment for its RV internals components is an acceptable means of managing the aging effects attributed to these components. The staff noted that the applicant's commitment is consistent with the recommended AMRs for Westinghouse-designed RV internals components documented in GALL Report, Table IV.B2, which recommends that these types of commitments to manage the aging effects be placed in the LRA.

Based on this review, the staff finds the applicant's response to RAIs B.2.40-1 and B.2.41-1 acceptable because the applicant has committed (Commitments No. 18 and No. 20 in UFSAR Supplement Tables A.4-1 and A.5.1 for Units 1 and 2, respectively) to manage cracking, loss of preload, changes in dimension and loss of fracture toughness in the RV internals components, as its basis for aging management. The staff further finds that the applicant's commitment conforms to the staff's aging management basis provided in the GALL Report, Table IV.B2. Therefore, the staff's concern described in RAIs B.2.40-1 and B.2.41-1 are resolved.

The staff also noted that the applicant's program elements for the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program indicate that the applicant may use the industry-wide initiatives of the EPRI MRP on PWR RV internals components, as an alternative basis for managing reduction of fracture toughness of the CASS RV internals components. The staff noted that the applicant's basis for using the EPRI MRP's flaw evaluation and inspection guidelines is provided through the PWR Vessel Internals Program, which includes Commitment No.18 in UFSAR Supplement Table A.4-1 for Unit 1 and Commitment No. 20 for UFSAR Supplement Table A.5-1 for Unit 2.

In RAI B.2.40-2, dated June 5, 2008, the staff requested that the applicant confirm its crediting of the industry initiatives of EPRI MPR as an alternative for managing reduction of fracture toughness in the CASS RV internals components and if so, amend the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program and its associated UFSAR supplement, to state that management of reduction of fracture toughness will be managed through the PWR Vessel Internals Program and the LRA Commitments No. 18 and No. 20.

In its response to RAI B.2.40-2, dated July 21, 2008, the applicant amended the LRA to delete the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program and UFSAR Supplement Section A.1.40. The applicant also amended LRA Table 3.1.2-2 (*i.e*., the management of loss of fracture toughness of the Unit 1 CASS RV internals lower support casting and the Units1 and 2 RV internals CASS upper internals assembly support column mixers) to delete the reference to the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (AMP B.2.40).

The applicant will credit LRA Commitments No.18 and No. 20 for RV internals components for Units 1 and 2, respectively, to manage loss of fracture that may occur in these components resulting from either thermal aging or neutron irradiation embrittlement.

The staff verified that the applicant has amended the LRA to include a commitment to manage the aging effects in the RV internals components. The staff's evaluation and basis for accepting the applicant's commitments for managing loss of fracture toughness of CASS RV internals components resulting from neutron irradiation embrittlement and thermal aging is found in SER Sections 3.1.2.1.2 and 3.0.3.1.20. In these SER sections, the staff provides the basis for concluding that the applicant's commitment for its RV internals components is an acceptable means of managing the aging effects attributed to these components. The staff noted that the applicant's commitment is consistent with the recommended AMRs for Westinghouse-designed RV internals components documented in GALL Report, Table IV.B2, which recommends that these types of commitments to manage the aging effects be placed in the LRA.

Based on its review, the staff finds that the applicant's response to RAI B.2.40-2 acceptable because the applicant has provided an acceptable basis for deleting the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program and UFSAR Supplement Section A.1.40 from the scope of the LRA, and has committed (Commitments No. 18 and No. 20 for Units 1 and 2, respectively) to manage loss of fracture toughness in the CASS RV internals components. The staff further finds that the applicant's commitments conform to the staff's aging management basis provided in the GALL Report, Table IV.B2. Therefore, the staff's concern described in RAI B.2.40-2 is resolved.

Since the staff has accepted the applicant's basis for deleting this AMP from the LRA, the staff finds that there is no reason to perform a program element evaluation of the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program that was originally docketed in the LRA.

Operating Experience. In the "operating experience" program element for this AMP, the applicant indicated that the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is a new program for which there is no operating experience to confirm its effectiveness in managing reduction of fracture toughness in the CASS RV internals components. The applicant also indicated that industry-specific and plant-specific operating experience will be considered in the development and implementation of Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program, and that as additional operating experience is obtained, lessons learned will be incorporated into the program.

The staff's basis for evaluating potential operating experience that may result from the initiation and implementation of new AMPs is found in SRP-LR Section A.1.2.310, Item 2, which states, "An applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness."

In RAI B.2-1, dated May 22, 2008, the staff requested that the applicant make such a commitment in the LRA for the new programs, including the PWR Vessel Internals Program, in order to bring these AMPs in conformance with the staff's "operating experience" criterion in SRP-LR Section A.1.2.3.10, Item 2. Therefore, RAI B.2-1 is applicable to the "operating experience" program element review for this AMP.

Industry operating experience regarding reduction of fracture toughness of CASS RV internals components is currently being compiled and assessed through the industry-wide initiatives of the EPRI MRP task group on PWR-designed RV internals components. The EPRI MRP initiatives on RV internals component degradation include material property studies on CASS materials used in the fabrication of PWR RV internals components. The staff noted that in the program elements for this AMP, the applicant indicates that it may apply the industry-wide initiatives of the EPRI MRP on PWR RV internals components as an alternative basis for managing reduction of fracture toughness in the CASS RV internals components at Units 1 and 2. Since operating experience on fracture toughness properties of CASS RV internals materials is being compiled and assessed through the initiatives of the EPRI MRP, the staff determined that additional information was required to complete its review.

In RAI B.2.40-2, dated June 5, 2008, the staff requested that the applicant confirm whether it was crediting the industry initiatives of the EPRI MPR as an alternative for managing reduction of fracture toughness in the CASS RV internals components in the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program and if so, whether the associated UFSAR Supplement would be amended to state that reduction of fracture toughness will be managed through the PWR Vessel Internals Program and the applicant's LRA commitments (Commitments No. 18 for Unit 1 and No. 20 BVPS Unit 2).

In its responses to RAI B.2-1, dated May 22, 2008 and RAI B.2.40-2, dated July 21, 2008, the applicant amended the LRA to delete the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program and the UFSAR Supplement for this AMP (*i.e*. LRA UFSAR Supplement Section A.1.40). The applicant also amended LRA Table 3.1.2-2, concerning management of loss of fracture toughness of the Unit 1 CASS RV internals lower support casting and the Units 1 and 2 RV internals CASS upper internals assembly support column mixers, to delete the reference to the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (AMP B.2.40). Instead, the applicant credits LRA Commitment No.18 for Unit 1 RV internals components and LRA Commitment No. 20 for Unit 2 RV internals components to manage loss of fracture that may occur in these components resulting from either thermal aging or neutron irradiation embrittlement.

The staff verified that the applicant has amended LRA. Based on its review of the applicant's responses to RAIs B.2-1 and B.2.40-2, the staff concludes that the applicant need not provide a commitment on the operating experience for the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program because the applicant has amended the LRA to delete this program and the associated UFSAR supplement from the scope of the LRA for BVPS. The staff finds the applicant's alternative basis to manage loss of fracture toughness in the Unit 1 CASS RV internals lower support casting and the Units 1 and 2 RV internals CASS upper internals assembly support column mixers acceptable because it conforms to the staff's recommended commitment-based aging management basis for Westinghouse RV internals components, as provided in the GALL Report, Table IV.B2. Therefore, the staff's concerns described in RAIs B.2-1 and B.2.40-2 are resolved.

UFSAR Supplement. The applicant provided its UFSAR supplement for the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program in LRA Section A.1.40.

The staff noted the applicant responses to RAIs B.2-1, B.2.40-1, B.2.41-1, and B.2.40-2 in which the applicant amended the LRA to delete the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program and the associated UFSAR supplement for this AMP (*i.e*. UFSAR Supplement Section A.1.40) from the scope of license renewal. The applicant also amended LRA Table 3.1.2-2, concerning the management of loss of fracture toughness of the Unit 1 CASS RV internals lower support casting and the Units 1 and 2 RV internals CASS upper internals assembly support column mixers, to delete the reference to the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program. Instead, the applicant credits LRA Commitments No.18 for Unit 1 RV internals components and No. 20 for Unit 2 RV internals components to manage loss of fracture that may occur in these components, resulting from either thermal aging or neutron irradiation embrittlement. The staff verified that the applicant amended the LRA and that the applicable commitments for the RV internals components are provided in Commitment No. 18 in UFSAR Supplement Table A.4-1 (Unit 1) and Commitment No. 20 of UFSAR Supplement Table A.5-1 (Unit 2).

Based on its review, the staff concludes that the LRA need not include a UFSAR supplement for the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program because the applicant has deleted this AMP from the scope of the LRA. The staff verified that the LRA and UFSAR supplement includes the appropriate commitments for the Unit 1 and Unit 2 RV internals components credited with aging management. The staff finds that the applicant’s basis for managing loss of fracture toughness in the Unit 1 CASS RV internals lower support casting and the Units 1 and 2 RV internals CASS upper internals assembly support column mixers acceptable because the applicant’s commitments are credited with management of this aging effect and because it conforms to staff’s aging management recommendations for Westinghouse-design RV internals components, as provided in the GALL Report, Table IV.B2. Therefore, the staff’s concerns described in RAIs B.2-1, B.2.40-1, B.2.41-1, and B.2.40-2 are resolved.

<u>Conclusion</u>. Based on its review, the staff concludes that the applicant has provided an acceptable alternative basis in Commitment No. 18 in UFSAR Supplement Table A.4-1 (Unit 1) and Commitment No. 20 of UFSAR Supplement Table A.5-1 (Unit 2) to manage to manage loss of fracture toughness in the Unit 1 CASS RV internals lower support casting and the Units 1 and 2 RV internals CASS upper internals assembly support column mixers. The staff also concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement and determines that it need not include a UFSAR Supplement summary description because the applicant has deleted the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program and associated UFSAR supplement for this AMP from the scope of the license renewal. The staff confirms that the applicant will rely on Commitment No. 18 in UFSAR Supplement Table A.4-1 (Unit 1) and Commitment No. 20 of UFSAR Supplement Table A.5-1 (Unit 2) to manage loss of fracture toughness in the Unit 1 CASS RV internals lower support casting and the Units 1 and 2 RV internals CASS upper internals assembly support column mixers.

3.0.3.1.23 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

<u>Summary of Technical Information in the Application</u>. In LRA Section B.2.41, the applicant described the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program as a new monitoring program designed to manage reduction of (loss of) fracture toughness in CASS components in the RCPB. This new program will not manage CASS RV internals, which

are managed by the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program. The applicant stated that the program elements for this new AMP are consistent with the program element criteria recommended in GALL AMP XI.12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," without exception or enhancement.

Staff Evaluation. The staff's aging management recommendations and program element criteria for Thermal Aging and Neutron Irradation Embrittlement of Cast Austenitic Stainless Steel (CASS) Programs are found in GALL AMP XI.M12. Guidance in the GALL Report establishes the criteria for determining whether a supplemental flaw tolerance assessment or volumetric or enhanced VT-1 visual inspection techniques should be credited to manage reduction of fracture toughness due to thermal aging embrittlement or neutron irradiation embrittlement in CASS RCS piping, piping components, or piping elements (including CASS valve bodes and CASS pump casings).

The guidance found in the NRC's letter of May 19, 2000 provides additional criteria for determining whether a particular CASS material is susceptible to thermal aging embrittlement and describes aging management strategies for these materials. The guidance in GALL AMP XI.M12, references the additional guidelines found in the May 19, 2000 NRC letter.

The staff reviewed the information in LRA Section B.2.41, Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program, and supporting BVPS-specific documents, against the staff's recommended program elements in GALL AMP XI.M12. The list of BVPS documents that were reviewed by the staff in its audit of March 3-7, 2008 and that support this AMP are provided in the Audit Summary dated November 6, 2008. The list of supporting documents reviewed by the staff includes the applicant's program evaluation document for this AMP.

The staff noted that the program elements for this AMP, as given in the applicant's program evaluation document for this AMP, were consistent with the program element criteria recommended in GALL AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)." Based on this review staff finds that the applicant's aging management basis and program elements for the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Program are acceptable because they are consistent with the staff's recommended aging management basis and program element that are defined in GALL AMP XI.M1, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)."

Operating Experience. In the "operating experience" program element for this AMP, the applicant indicated that AMP B.2.41, Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program Thermal program is a new program for the BVPS facility, and that as such, there is no OE yet to confirm the effectiveness of the AMP in managing reduction of fracture toughness in the CASS RCPB components. In its "operating experience" program element, the applicant also indicated that industry-specific and plant-specific OE will be considered in the development and implementation of this AMP, and that as additional OE is obtained, lessons learned will be appropriately incorporated into the program.

The staff's basis for evaluating potential operating experience that may result from the initiation and implementation of new AMPs is provided in SRP-LR Section A.1.2.310, Item 2, which states:

> An applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

In RAI B.2-1 dated May 22, 2008, the staff requested that the applicant make such a commitment for the new programs in the LRA in order to bring these AMPs in conformance with the staff's "operating experience" criterion in SRP-LR Branch Position RLSB-1, Section A.1.2.310, Item 2. Therefore, RAI B.2-1 on a commitment for new program is thus applicable to the OE program element review for this AMP.

In response to RAI B.2.-1 dated August 22, 2008, the applicant responded to RAI B.2-1, relative to B.2.41, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program." the applicant stated the following:

> "For potentially susceptible materials that are part of the reactor coolant pressure boundary, this program will consist of either volumetric examination of the base metal or a component-specific flaw tolerance evaluation. Potentially susceptible components that are not part of the reactor coolant pressure boundary will be inspected, evaluated, or replaced as appropriate. BVPS will determine required inspections on a case by case basis.
>
> To date, there has been no BVPS plant-specific operating experience regarding degradation of austenitic stainless steel castings due to thermal aging. The Aging Management Program described in NUREG-1801, Section XI.M12 was developed by using research data obtained on both laboratory-aged and service-aged materials.
>
> The BVPS LRA states that, "Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program."

The staff noted that in this response the applicant stated that any operating experience that results from implementation of this AMP will be evaluated and lesson learned incorporated into the AMP. The staff verified that, in the enclosure to the letter of August 22, 2008, the applicant placed Commitment No. 29 on UFSAR Supplement Table A.4-1 for Unit 1 and Commitment No. 28 in UFSAR Supplement Table A.5-1 for Unit to address the need for evaluating operating experience that results from the applicant's implementation of new programs during the period of extended operation. The staff verified that in these commitments, the applicant committed to confirming "the effectiveness of the license renewal aging management programs based on the incorporation of operating experience by performing a program self assessment of all new license renewal aging management programs."

The staff noted that incorporation of these commitments into the UFSAR Supplement for the application addresses the staff's recommendation in SRP-LR Section A.1.2.3.10, part b. and the need for the applicant to reassess relevant operating experience on the program element activities for the applicant's new programs relative to the SRP-LR recommendations.

RAI B.2-1 is resolved with respect to the need for reassessing AMP B.2.41, Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program for relevant operating experience during the period of extended operation.

UFSAR Supplement. The applicant provides its UFSAR Supplement for its Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program in LRA Section A.1.41. The staff verified that UFSAR Supplement summary description for the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program was in conformance with the staff's recommended UFSAR Supplement summary description for these type of AMPs in Table 3.1-2 of the SRP-LR.

The staff also noted that the applicant committed to the implementation of this AMP during the period of extended operation in Commitment No. 22 of UFSAR Supplement Table A.4-1 for Unit 1 and Commitment No. 24 of UFSAR Supplement Table A.5-1 for Unit 2. The staff also verified that the applicant has amended the LRA to incorporate No. 29 of UFSAR Supplement Table A.4-1 for Unit 1 and Commitment No. 28 of UFSAR Supplement Table A.5-1 for Unit 2 onto the scope of the LRA and to commit to confirming the effectiveness of the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program by incorporating of any relevant operating experience on the program element activities for the AMP and by performing a programmatic self assessment of the AMP to ensure that its program element activities will be capable of achieving the intended aging management objectives that are defined in SRP-LR Section A.1.2.3. Based on this review, the staff finds that the UFSAR Supplement for the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program because it is in conformance with the recommended UFSAR Supplement summary description for these type of AMPs in SRP-LR Table 3.1-2 and because the UFSAR Supplement includes Commitment No. 22 and 29 of UFSAR Supplement Table A.4-1 for Unit 1 and Commitment No. 24 and 28 of UFSAR Supplement Table A.5-1 for Unit 2.

Conclusion. Based on its review of the applicant's Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program, the staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2 AMPs Consistent with the GALL Report with Exceptions or Enhancements

In LRA Appendix B, the applicant stated that the following AMPs are, or will be, consistent with the GALL Report, with exceptions or enhancements:

- ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- ASME Code Section XI, Subsection IWE Program
- ASME Code Section XI, Subsection IWF Program
- Closed-Cycle Cooling Water System Program
- Fire Protection Program

- Fire Water System Program
- Flux Thimble Tube Inspection Program
- Fuel Oil Chemistry Program
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program
- Masonry Wall Program
- Reactor Head Closure Studs Program
- Structures Monitoring Program
- Water Chemistry Program

For AMPs that the applicant claimed are consistent with the GALL Report, with exception(s) and/or enhancement(s), the staff performed an audit and review to confirm that those attributes or features of the program, for which the applicant claimed consistency with the GALL Report, were indeed consistent. The staff also reviewed the exception(s) and/or enhancement(s) to the GALL Report to determine whether they were acceptable and adequate. The results of the staff's audits and reviews are documented in the following sections.

3.0.3.2.1 ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program

Summary of Technical Information in the Application. In LRA Section B.2.2, the applicant described the ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, IWD Program as an existing condition monitoring program designed to manage the effects of aging in Class 1, 2, and 3 pressure retaining components, including associated welds, pump casings, valve bodies, integral attachments, and pressure retaining bolting. The applicant stated the ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, IWD Program is updated periodically pursuant to 10 CFR 5055a and is consistent with the program element criteria recommended in GALL AMP XI.M1, "ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," with an exception.

Exception. The applicant stated that this AMP includes the following exception to the "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program element criteria recommended in GALL AMP XI.M1:

> NUREG-1801, Section XI.M1, *ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD* specifies the use of ASME Code Section XI, 2001 edition through 2002 and 2003 Addenda. The applicable ASME Code for the third (Unit 1 only) and second (Unit 2 only) intervals of the BVPS ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program is ASME Code Section XI, 1989 edition (with no Addenda). The use of the 1989 edition of the ASME Code is consistent with provisions in 10 CFR 50.55a to use the Code in effect 12 months prior to the start of the inspection interval.
>
> BVPS will use the ASME Code edition consistent with the provisions of 10 CFR 50.55a during the period of extended operation.

The applicant also provided a summary of the ISI results for examinations performed during the last RFOs for Units 1 and 2 and of the latest BVPS-implemented quality assurance audits and staff inspection conducted on the ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, IWD Program. The applicant provided technical details of these operating experience aspects in the “operating experience” program element discussion in LRA Section B.2.2.

Staff Evaluation. The staff’s aging management recommendations and program element criteria for the ASME Code Section XI Inservice Inspection, Subsection IWB, IWC and IWD Programs are described in GALL AMP XI.M1.

The requirements found in 10 CFR 50.55a and ASME Code Section XI, Subsections IWA, IWB, IWC, and IWC are applicable to the staff’s review of the applicant’s ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The requirements of ASME Code Section XI, Subsection IWF are applicable if an applicant chooses to include ASME Code Class 1, 2, and 3 component supports within the scope of its ASME Code Section XI Inservice Inspection, Subsection IWB, IWC and IWD Program.

The staff reviewed the information in LRA Section B.2.2 against the regulatory criteria discussed in the Staff Evaluation section. With the exception taken on the ASME Code editions for this AMP, the staff verified that the program elements for the applicant’s ASME Code Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program were consistent with the program element criteria recommended in the program elements of GALL AMP XI.M1. The staff concludes that the program element aspects of the applicant’s AMP claim of consistency with the GALL Report are acceptable because the staff verified that these program element criteria are consistent with the corresponding program element criteria recommended in GALL AMP XI.M1. The staff evaluates the exception taken on the ASME Code Section XI edition in the paragraphs that follow

Assessment of the Exception Taken to GALL. GALL AMP XI.M1 recommends that the inspection, repair, and replacement of ASME Code Class 1, 2, and 3 components are covered in the 2001 edition of the ASME Code Section, Subsections IWB, IWC, and IWD, inclusive of the 2002 and 2003 Addenda. The applicant has taken an exception on the ASME Code Section XI code edition in that the applicant identified that the current ASME Code Section XI edition or record for BVPS Units 1 and 2 is the 1989 edition of the ASME Code Section XI, with no applicable addenda and that it is crediting this edition of the ASME Code Section XI for aging management. This was the ASME Code Section XI edition in effect for the 3rd 10-Year ISI Interval for BVPS Unit 1 and the 2nd 10-Year ISI Interval for BVPS Unit 2. The staff noted that the applicant had indicated BVPS Unit 1 had entered its 4th 10-Year ISI Interval on April 1, 2008 and that BVPS Unit 2 is scheduled to enter its 3rd 10-Year ISI Interval for BVPS Unit 2 on August 29, 2008. Under the requirements of 10 CFR 50.55a, the applicant was required to implement the 2001 Edition ASME Code Section XI, inclusive of the 2003 Addenda, upon entrance into the 4th 10-Year ISI Interval for BVPS Unit 1 and will be required to implement the 2001 Edition of the ASME Code Section XI upon entrance into the 3rd 10-Year ISI Interval for BVPS Unit 2.

In RAI B.2-2, dated June 5, 2008, the staff requested the applicant clarify which ASME Code Section XI edition will be credited for those AMPs that credit the ASME Code Section XI criteria for aging management of ASME Code Class components, structures, or supports.

In its response to RAI B.2-2, dated July 21, 2008, the applicant clarified the that ASME Code Section XI editions of record credited for ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program for Units 1 and 2 are the ASME Code Section XI, 2001 Edition, inclusive of the 2003 Addenda pending renewal of the operating license for Units 1 and 2 (*i.e.*, the 4th 10-Year and 3rd 10-Year ISI Intervals are in effect for Unit 1 and Unit 2, respectively) The applicant clarified that updates of the ASME Code Section XI editions will be implemented through the 10 CFR 50.55a code update process.

In its final statement of considerations on changes to 10 CFR 50.55a endorsing new ASME Code Section XI editions, the staff noted that it endorses the editions not only for the current operating term but also for the period of extended operation. The staff further noted that the 2004 Edition of the ASME Code Section XI is the most recent edition endorsed for both the current operating period and the period of extended operation (refer to Federal Register Volume 73, No. 176 [September 10, 2008]).

The staff also noted that the ASME Code Section XI edition credited for aging management in the applicant's response to RAI B.2-2 was consistent with the ASME Code Section edition that is recommended to for aging management in GALL AMP XI.M1. The staff finds this edition of the ASME Code Section XI acceptable because it conforms to the edition recommended for aging management in program elements in GALL AMP XI.M1. The staff further finds this edition acceptable because the process to update the edition of record is consistent with the staff's ASME Code Section XI update process pursuant to 10 CFR 50.55a(g)(4)(ii) and the staff's process to approve updated editions of the ASME Code Section XI for license renewal as provided in the final statements of consideration on updates to 10 CFR 50.55a ISI requirements. Therefore, the staff's concern described in RAI B.2-2 is resolved.

Based on the clarification that ASME Code Section XI edition of record for aging management is the 2001 Edition of the ASME Code Section XI, inclusive of the 2003 Addenda, and that the edition will be updated to the most recent edition endorsed in 10 CFR 50.55a and approved for the 5th 10-Year ISI Internal (which is the first full 1-Year ISI Interval in the period of extended operation, the staff finds that the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to be acceptable because the staff has verified that the program elements for the AMP are consistent with the staff's recommended program element criteria in GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD."

<u>Operating Experience</u>. The staff reviewed the applicant's operating experience basis document for safety significant operating experience relevant to aging management of ASME Code Class 1, 2, and 3 components. The staff placed emphasis on operating experience that could impact the ability of these components to maintain the pressure boundary integrity functions, with particular interest in operating experience that could impact the pressure boundary integrity functions of the ASME Code Class 1 components in the RCPB. More specifically, the staff reviewed the integrity of ASME Code Class 1 nickel-alloy base metal components and/or ASME Code Class 1 base metal components with associated nickel-alloy pressure boundary welds.

The staff noted that although the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program provides the applicant's augmented inspection program for managing PWSCC in the upper RV closure head penetration nozzles, the applicant implements the augmented inspection requirements for these nozzles pursuant to NRC Order EA-03-009, as amended, through its 10-Year ISI plans for Units 1 and 2. Thus, the applicant addresses relevant safety significant operating experience on nickel-alloy upper RV closure head penetration nozzles through the program elements of its Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program, and implements the mandated augmented inspections of these components through its 10-Year ISI plans for Units 1 and 2. BVPS-specific and generic industry-wide operating experience with upper RV closure head nozzles is managed through the applicant's Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program and implemented through both the Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program and the applicant's ASME Code Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program.

The staff verified that the applicant has adequately addressed relevant operating experience on PWCCC of upper RV closure head penetration nozzles and factored the relevant operating experience into the its Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head and ASME Code Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Programs. Therefore, the staff finds the applicant's basis for addressing this operating experience acceptable. The staff evaluation of the applicant's Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head Program is discussed in SER Section 3.0.3.1.16 and includes the staff's operating experience evaluation of flaw indications detected in the Unit 2 upper RV closure head nozzles during RFO #2R12 (2006).

The staff noted that the Nickel-Alloy Nozzles and Penetrations Program provides the applicant's augmented inspection program for managing PWSCC in the remaining nickel-alloy Class 1 base metal and weld locations. The program includes the applicant's commitment (Commitment No. 15 for Unit 1 and Commitment No. 17 for Unit 2) to implement it commitments that have been made to applicable NRC Orders, GLs, and Bulletins on nickel-alloy component cracking. The staff confirmed that the applicant has implemented the augmented inspection criteria for these nickel-alloy components through implementation of its 10-Year ISI plans for the BVPS units. The staff has also confirmed that the applicant has adequately addressed relevant operating experience on PWCCC of ASME Code Class 1 nickel-alloy components and factored the relevant operating experience into the applicant's Nickel-Alloy Nozzles and Penetrations and ASME Code Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Programs, and finds the applicant basis for addressing this operating experience to be acceptable. The staff evaluation of the applicant's Nickel-Alloy Nozzles and Penetrations Program is discussed in SER Section 3.0.3.3.3. The staff's evaluation includes resolution of RAI B.2.28-3, in which the staff requested that the applicant clarify whether the scope of its responses and commitments made in response to NRC Bulletin 2003-02 (lower RV closure head bottom-mounted instrumentation nozzle cracking and Bulletin 2004-01 on nickel-alloy pressurizer components cracking) were within the scope of the applicant's Nickel-Alloy Nozzles and Penetrations Program.

Based on these reviews, the staff confirms that the applicant has appropriately augmented its ASME Code Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Programs to factor in relevant safety-significant Code Class operating experience.

UFSAR Supplement. The applicant provided its UFSAR Supplement for the ASME Code Section XI Inservice Inspection, Subsection IWB, IWC and IWD Program in LRA Section A.1.2. In the Staff Evaluation section, the staff provided its basis for accepting the applicant's exception to the ASME Code Section XI edition or record program for use as the basis for the ASME Code Section XI Inservice Inspection, Subsection IWB, IWC and IWD Program.

The staff reviewed the UFSAR Supplement described in LRA Section A.1.2 and determines that the applicant's UFSAR Supplement for the ASME Code Section XI Inservice Inspection, Subsection IWB, IWC and IWD Program provides an acceptable description of the program because it appropriately indicates that the program is implemented in accordance with the ISI requirements of 10 CFR 50.55a and the ASME Code Section XI and because the applicant credits an acceptable edition of the ASME Code Section XI (i.e. the 2001 Edition inclusive of the 2001 Addenda) for aging management of its ASME Code Class components. Based on its review, the staff determines that the applicant's UFSAR Supplement for the ASME Code Section XI Inservice Inspection, Subsection IWB, IWC and IWD Program provides an acceptable summary description of the AMP, as required by 10 CFR 54.21(d).

Conclusion. Based on its review of the applicant's Inservice Inspection Program, the staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 ASME Code Section XI, Subsection IWE Program

Summary of Technical Information in the Application. In LRA Section B.2.3, the applicant described the existing ASME Code Section XI, Subsection IWE Program as consistent, with exception, with GALL AMP XI.S1 "ASME Code Section XI, Subsection IWE." This program is implemented through plant procedures, which provide for ISI of Class MC and metallic liners of Class CC components.

Section 50.55a of 10 CFR specifies the use of the examination requirements in the ASME Code, Section XI, Subsection IWE, for steel liners of concrete containments and other containment components. The applicant stated that it has implemented ASME Code Section XI, Subsection IWE, 1992 Edition with the 1992 Addenda, and will use the ASME Code edition consistent with the provisions of 10 CFR 50.55a, during the period of extended operation.

Staff Evaluation. In the LRA, the applicant stated that ASME Code Section XI, Subsection IWE is an existing program that is consistent, with exception, with GALL AMP XI.S1.

During the audit, the staff interviewed the applicant's technical staff and audited the applicant's ASME Code Section XI, Subsection IWE Program onsite basis documents to confirm the applicant's claim of consistency with GALL AMP XI.S1. In addition, the staff reviewed the exception and its justification to determine whether the AMP, with the exception, remains adequate to manage the aging effects for which it is credited.

The applicant's ASME Code Section XI, Subsection IWE Program takes exception to the scope of program, parameters monitored or inspected, detection of aging effect, monitoring and trending, acceptance criteria, and corrective action program elements in that it did not use the ASME Code Section XI, Subsection IWE, 2001 edition, with the 2002 through 2003 Addenda. In the LRA, the applicant stated that its use of the ASME Code 1992 edition through the 1992 Addenda complies with 10 CFR 50.55a which requires use of the Code in effect 12 months prior to the start of the inspection interval. The applicant further committed that it will use the ASME Code edition consistent with the provisions of 10 CFR 50.55a during the period of extended operation. The staff issued generic RAI B.2-2, by letter dated June 5, 2008, requesting that the applicant clarify which edition of the ASME Code Section XI will be credited for those AMPs that credit the ASME Code Section XI, during the period of extended operation. The staff's review of RAI B.2-2 is documented in SER Section 3.0.3.2.1.

The staff reviewed the exception described in LRA Section B.2.3 and additional information provided by the applicant in its response to RAI B.2-2 dated July 21, 2008. The staff finds that the exception to the use of the ASME Code Section XI, Subsection IWE, 1992 edition with 1992 Addenda is within the limitations and modifications required by 10 CFR 50.55a. The applicant's assurance of the use of subsequent editions and addenda of ASME Code Section XI, Subsection IWE, as required by 10 CFR 50.55a ensures that the applicant's IWE program will be consistent with GALL AMP XI.S1 during the period of extended operation. Based on its review, the staff finds the applicant's exceptions to the use of the IWE program acceptable.

Operating Experience. The staff also reviewed the operating experience, including samples of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. However, during its review audit, the staff noted that a temporary construction opening was created in 2006 for the Unit 1 SG and reactor head replacements. Inspections during RFO 17 (2006) revealed degradation from the inaccessible side of the steel liner, for which the applicant could not identify a root-cause from observations in field or from lab analysis. To ensure the essential leak-tight condition of the containment, the staff identified three issues where additional clarifications and justifications were needed to complete the review.

In RAI B.2.3-1, dated May 8, 2008, that staff requested that the applicant provide information related to the minimum required thickness of the liner; discuss the possibility and severity of similar corrosion at other locations, including Unit 2 containment; and justify whether the corrosion is active. Furthermore, the staff requested the applicant discuss the use of the GALL Report which recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas, if corrosion is significant.

In its response to RAI B.2.3-1, dated June 16, 2008, the applicant stated:

> Analyses and evaluations of the Unit 1 containment liner corrosion in 2006 were performed for FENOC by several vendors that specialize in these types of analyses and by the FirstEnergy Beta Laboratory.
>
> The Shaw Group, Inc., evaluated the condition of the Unit 1 containment liner regarding the extent of the degradation and effects on intended function following the discovery of the containment liner corrosion in 2006. The evaluation included

consideration of the impact of an additional 20 years of operation as a result of license renewal on the recurring Integrated Leak Rate Test loading.

In the Shaw Group's report, design basis calculations originally developed for the BVPS Unit 1 containment liner were used to demonstrate that the degraded conditions found on the liner did not adversely affect its mechanical/structural function as a leak-tight membrane. The thickness of the remaining sound metal was determined to be adequate to maintain the design safety function of the liner. In addition, the capacity of the concrete containment structure to withstand Design Basis Accident loadings was not adversely affected.

Of the three areas of corrosion identified, two were replaced with new plate material. The third area showed minimal wall loss at the deepest pit, and was left in place for further monitoring. In addition to initial "baseline" ultrasonic thickness measurements in accordance with Table IWE-2500-1, examination category E-C, it was recommended that the third area of degradation be mapped on the inside of the containment liner for future UT examinations. It was recommended that this area be examined for the next three inspection periods. If no change in liner thickness was detected after three inspection periods, it was determined that the area would require no additional inspections. Further engineering evaluation was recommended if the thickness changed. FENOC has scheduled additional UT examinations as recommended by The Shaw Group, Inc., for the three inspection periods following the 2006 RFO when the degradation was discovered.

A material analysis was performed by the FirstEnergy Beta Laboratory on the corroded steel liner areas and sample pieces of concrete to aid in determining a cause of the corrosion. The following conclusions were drawn concerning the corrosion activities:

- The corrosion was general pitting corrosion (wastage) with no evidence of stress corrosion or microbiological attack. The metallographic work performed by Beta Labs found the pitting to be rounded in nature with no crack like projections. The examination of the corrosion product trapped in the deep pits identified no unusual levels of elements that were not expected to be present. No preferential corrosion attack was observed on the sample piece with the weld or on the welds around the Nelson studs welded to the liner plate. Some crevice corrosion was observed in the cross section of the studs where the flash weld could trap contaminates.

- The corrosion occurred after welding and construction of the liner plate since the corrosion pitting was even across the weld, the heat affected zone (HAZ) and both edges of the weld where weld prep would have occurred. No preferential corrosion occurred at the weld or HAZ.

- The necessary elements for corrosion (oxygen and water) were present throughout the construction phase of Unit 1, from the fabrication and erection of the liner plate through the completion of concrete pours for the top of the containment structure. During this timeframe, water, in the form of the wetting methodology used during the concrete pour sequences and weather (rain and snow), could accumulate in areas between the liner plate and the concrete structure. Corrosion activities are likely to have initiated during this construction period.

- Access to these necessary elements for corrosion activity became significantly limited once the concrete structure was completed. Exposure to water sources all but ceased, and the concrete/steel interface was no longer exposed to the atmosphere for re-oxygenation.

- The corrosion process consumes oxygen, and, once it is depleted, corrosion can not be sustained at a high rate due to the limited supply of oxygen between the concrete and the liner plate following fabrication.

- No corrosive agents or corrosion catalysts, such as chlorides, could be identified on or in the steel liner plate. Additionally, no corrosion agents were found in the pitted areas of the liner plate or in the concrete materials tested in concentrations that would be of concern. However, it must be considered that such materials may have existed in local areas and were removed during the water hydrolyzing process that was used to remove the exterior containment concrete.

- Approximately 1% of the observable liner plate (portion removed for the construction opening) contained corroded areas and a much smaller percentage of the rebar surface area had evidence of corrosion. So, it is reasonable to assume that the concrete did not contain corrosive agents, and that corrosion elements (water and oxygen) were not present in abundant amounts. This finding would support the general conclusion that no general corrosion is active in the area between the liner plate and the concrete.

- The corrosion is localized for reasons that can not be determined with certainty. However, small breaks in the mill scale surface or other surface imperfections can provide the initiation sites for pitting (oxygen cell corrosion) during the time of construction when oxygen and water were known to be present.

- The concrete did contain small void areas at the concrete/steel interface. These voids would most likely have filled with water during the construction phase. During the post-construction life of the liner, these locations could also serve as an accumulation point for any moisture that enters the concrete structure. However, the area of the containment liner where the concrete was found to have small voids at the steel/concrete interface had no corrosion activity.

- Foreign material has been identified by other power plants that removed the liner plate from the inside of containment leaving the concrete in place. The foreign debris was identifiable in these instances since the corrosion product was available for analysis. At BVPS, little or no corrosion product remained following the water hydrolyzing, so no conclusions could be drawn regarding the source of the corrosion.

A vendor materials specialist was commissioned to perform a corrosion assessment of the corroded steel liner, and stated that the primary source of passivation of the steel used in fabrication of the containment liner, studs and rebar is the concrete itself. The passivity of the steel depends upon the quality of the concrete in contact with the steel and the intimate contact of the steel to the concrete. The vendor concluded that, where the containment steel liner, studs and rebar are in contact with the concrete cover, the containment steel liner at BVPS Unit 1 would be in a passivated state and not subject to oxygen concentration cell corrosion. The visual inspection of the removed cutout and rebar identified that the majority (over 99%) of the surfaces in contact with the concrete were passive to an oxygen concentration cell corrosion mechanism.

Based on its review, the staff finds the applicant's response to RAI B.2.3-1 acceptable because the applicant has adequately explained that corrosion of the liner plate or rebar materials from the concrete side of the liner plate is passive because there is no active mechanism for corrosion. The staff determines that the Shaw Group's evaluation of the Unit 1 containment liner confirmed that the degraded conditions found on the liner did not adversely affect its mechanical and/or structural function as a leak-tight membrane. Therefore, the staff's concern described in RAI B.2.3-1 is resolved.

In LRA Section B.2.3, the applicant stated that following RFO 17 (2006) for Unit 1, test procedures for the evaluation of the containment liner plates were modified at both units. The staff determined that additional information was required to complete its review.

In RAI B.2.3-2, dated May 8, 2008, the staff requested that the applicant identify which test procedures or part of the procedures were modified and compare them with previous procedures, as well as those required by ASME Code Section XI, Subsection IWE. The applicant was also asked to explain whether the modified test procedures help detect similar containment liner degradation on the side that is in contact with the concrete and; if not, how the applicant will ensure that similar degradation, if any, is detected.

In its response to RAI B.2.3-2, dated June 16, 2008, the applicant explained that the procedures for Units 1 and 2 were modified to include two additional requirements in the containment inspection procedures, resulting from the liner corrosion found in 2006: (1) when paint or coatings are removed for further inspection, the paint or coatings shall be visually examined by a qualified VT-3 inspector prior to removal, and (2) if the visual examination detects surface flaws on the liner or suspect areas on the liner plate that could potentially impact the leak tightness or structural integrity of the liner, then surface or volumetric examinations shall be performed to characterize the condition (*i.e.*, depth, size, shape, orientation). The applicant further stated that these additional examination requirements and the use of the FENOC Corrective Action Program provide reasonable assurance that potential corrosion on the concrete side of the containment liner plate will be identified and addressed.

Based on its review, the staff finds the applicant's response to RAI B.2.3-2 acceptable because the applicant described the modifications of the containment inspection procedures that will identify additional areas of corrosion (if any). These procedures will be incorporated as part of the ASME Code XI, Subsection IWE examinations. Therefore, the staff's concerns described in RAI B.2.3-2 are resolved.

The staff reviewed that applicant's ASME Code Section XI, Subsection IWE Program. The GALL AMP XI.S1 states that ASME Code Section XI paragraph IWE-1240 requires augmented examinations of containment surface areas that are subject to degradation. The staff determined that additional information was required to complete the review.

In RAI B.2.3-3, dated May 8, 2008, the staff requested that applicant historically explain what inspection findings under the BVPS ISI – IWE Program, including the 2006 findings of the liner degradation on the side in contact with concrete, have led to the need for augmented inspections.

In its response to RAI B.2.3-3, dated June 16, 2008, the applicant stated that Units 1 and 2 do not meet the criteria for ASME Code augmented examinations as defined in ASME Code XI, IWE-1240. There are no augmented examinations being performed on examination surface areas at Units 1 or 2 as defined in ASME Code Section XI, Subsection IWE-1240. However, the applicant further explained that two of the three degraded areas were removed and replaced with new plate material in 2006, following the discovery of corrosion on the concrete side of the liner plate. The third area was found acceptable from examination and laboratory analysis and was left in place. As part of the corrective actions from the discovery, this third area is monitored with additional examinations. FENOC has scheduled additional UT examinations as recommended by The Shaw Group, Incorporated for the three inspection periods following RFO 17 (2006), when the degradation was discovered.

Based on its review, the staff finds the applicant's response to RAI B.2.3-3 acceptable because the applicant has verified that Units 1 and 2 do not meet the criteria for ASME Code augmented examinations as defined in ASME Code Section XI, IWE-1240. Two of the three unacceptable degraded areas were removed and replaced with new plate material following the discovery of the corrosion on the concrete side of the liner plate during RFO 17 (2006). Therefore, the staff's concerns described in RAI B.2.3-3 are resolved.

On April 23, 2009, during a Unit 1 IWE inspection, a paint blister was discovered on the containment liner. Further investigation revealed through-wall corrosion of the containment liner. In response to this operating experience, by letter dated May 7, 2009, the staff issued RAI B.2.3-4, requesting the applicant to explain how the recent plant-specific operating experience, as well as the 2006 degradation, would be incorporated into the ASME Section XI, Subsection IWE AMP.

In its response, dated June 1, 2009, the applicant stated that the procedures for both Units were modified following the 2006 degradation to include the following acceptance criteria:

1. When paint or coatings are to be removed for further inspection, the paint or coatings shall be visually examined by a qualified VT-3 inspector prior to removal.

2. If the visual examination detects surface flaws on the liner or suspect areas on the liner plate that could potentially impact leak tightness or structural integrity of

the liner, then surface or volumetric examinations shall be performed to characterize the condition (i.e., depth, size, shape, orientation).

The applicant also explained that visual examinations of 100% of the accessible liner area have been scheduled for Unit 1 refueling outage 1R20 in fall 2010 and Unit 2 refueling outage 2R14 in fall 2009. A UT inspection of the repaired area is also scheduled for outage 1R20. In addition to the visual inspections, the applicant committed to perform supplemental volumetric examinations of 75 one foot square sample locations at each unit prior to the period of extended operation.

The following table provides the relevant past operating experience, as well as proposed future actions.

Unit	Date	Activity
1	May 2006	Found three small areas of degraded liner plate. Two areas removed and replaced. Third area found acceptable. Successful integrated leakage rate test (ILRT) after repair
2	May 2008	Successful integrated leakage rate test (ILRT)
1	April 2009	IWE inspection found a 3/8"x 1" hole in liner plate which was removed and replaced
2	October 2009	100 percent visual examination of liner plate
1	October 2010	100 percent visual examination of liner plate
2	April 2011	Scheduled IWE program visual examination of liner plate
1	April 2012	Scheduled IWE program visual examination of liner plate
1	January 2016	Volumetric examination of 75 one foot square area of liner plate prior to the start of extended period of operation
2	May 2027	Volumetric examination of 75 one foot square area of liner plate prior to the start of extended period of operation

The staff reviewed the applicant's RAI response, and participated in a conference call with the applicant on June 4, 2009. During the call, the staff asked for clarification on the supplemental volumetric examinations including: (1) a discussion of the method used to select the examination locations; (2) an explanation of the resulting actions if degradation was found; and (3) an explanation of the implementation timeframe.

During the conference call, the applicant explained that the sample locations have not been decided yet, but will focus on areas most likely to experience similar degradation, such as locations at similar elevations, or areas that have required recoating in the past. The applicant further explained that the sample locations would not be completely random, but would be based on past operating experience. During the call the applicant also stated that if degradation is identified during the supplemental volumetric examinations, the degradation would be entered into the applicant's corrective action program. Depending on the type and extent of degradation, the corrective actions may include reanalyzing and increasing the sample size. In response to the implementation timeframe, the applicant stated that the program is currently being evaluated to decide when the examinations will take place. The applicant has committed to completing the supplemental volumetric examinations prior to the period of extended operation for each unit.

Based on its review, the staff finds the applicant's response to RAI B.2.3-4 acceptable because the applicant's aging management program incorporates the recent plant-specific operating experience. The modified procedures, along with the 100% visual examination of the liner plate during the next outage and the supplemental volumetric examinations prior to entering the period of extended operation, provide reasonable assurance that the AMP is adequate to manage the aging effects for which it is credited in the LRA. The staff's concerns regarding license renewal, as described in RAI B.2.3-4 are resolved. The impact of this operating experience on the current operation of the plant is being reviewed under the provisions of the applicant's 10 CFR Part 50 operating license.

In response to questions raised during the ACRS sub-committee meeting on February 4, 2009, the staff issued RAI B.2.3-5, by letter dated May 7, 2009. The RAI requested the applicant to explain how their IWE Program was enhanced as discussed during the meeting, and how these enhancements compared to the ASME code required augmented inspections.

In its response, dated June 1, 2009, the applicant stated that the program was not enhanced to achieve GALL consistency as described in NUREG-1800. The procedures were modified, as discussed above, to identify additional actions in the event suspect surfaces are identified by the IWE visual inspection. The applicant further stated that UT examinations were performed on the area of degradation discovered during the 2006 steam generator replacement outage which was left in place. The applicant explained that these examinations were corrective actions related to the degradation and are not considered IWE augmented examinations since the degradation was discovered outside of the scheduled IWE examinations. The applicant also stated that the through-wall degradation discovered in April 2009 during an IWE examination does not require augmented examinations because the degraded area was replaced. The applicant stated that the corrective actions from the 2009 degradation include 100% visual inspection of the accessible liner during the next outage, a UT inspection of the replaced area, and supplemental volumetric inspections. These are not characterized as IWE augmented examinations.

Based on its review, the staff finds the applicant's response to RAI B.2.3-5 acceptable because it explains how the program was enhanced and why the degraded areas do not fall under the IWE Examination Category E-C (i.e., augmented examination). The 2006 degradation was not discovered during an IWE examination and the corrective actions are not tracked under the IWE AMP, while the 2009 degradation does not require IWE augmented examinations per IWE-2420 because the area was replaced. The staff's concerns described in RAI B.2.3-5 are resolved.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds the program element acceptable.

UFSAR Supplement. The applicant provided the UFSAR supplement for the ASME Code Section XI, Subsection IWE Program in LRA Section A.1.3. The staff reviewed this Section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. The staff reviewed the information in LRA Section B.2.3 and additional information provided by the applicant by letter dated June 16, 2008. The staff finds that those attributes of the applicant's ASME Code Section XI, Subsection IWE Program for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the applicant's exception and justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it.

Based on its review, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 ASME Code Section XI, Subsection IWF Program

Summary of Technical Information in the Application. In LRA Section B.2.4, the applicant described the existing ASME Code Section XI, Subsection IWF Program as consistent, with exception, with GALL AMP XI.S3 “ASME Code Section XI, Subsection IWF.” This program is implemented through plant procedures which provide for visual examination of ISI Class 1, 2, and 3 supports in accordance with the requirements of ASME Code Case N-491, Alternate Rules for Examination of Class 1, 2, 3, and MC Component Supports of Light-Water Cooled Power.

The ASME Code Section XI, Subsection IWF Program consists of periodic visual examination of ASME Code Section XI Class 1, 2, 3 and MC components and piping support members for loss of mechanical function and material. The applicant stated that it has implemented ASME Code Section XI, Subsection IWF, 1989 Edition with no Addenda, and will use the ASME Code edition consistent with the requirements of 10 CFR 50.55a during the period of extended operation.

Staff Evaluation. In the LRA, the applicant stated that ASME Code Section XI, Subsection IWF is an existing program that is consistent, with exception, with GALL AMP XI.S3.

During its audit, the staff interviewed the applicant's technical staff and audited the applicant’s ASME Code Section XI, Subsection IWF Program onsite basis documents to confirm the applicant’s claim of consistency with GALL AMP XI.S3. Furthermore, the staff reviewed the exception and its justification to determine whether the AMP, with the exception, remains adequate to manage the aging effects for which it is credited.

The applicant’s ASME Code Section XI, Subsection IWF Program takes exception to the scope of program, parameters monitored or inspected, detection of aging effect, monitoring and trending, acceptance criteria, and corrective actions program elements in that it has not used ASME Code Section XI, Subsection IWF, 2001 Edition, with the 2002 through 2003 Addenda. In the LRA, the applicant stated that the use of the ASME Code, 1989 Edition with no Addenda for the third (Unit 1 only) and second (Unit 2 only) ISI intervals is consistent with 10 CFR 50.55a which requires use the Code in effect 12 months prior to the start of the inspection interval. The applicant further committed that it will use the ASME Code edition, consistent with the provisions of 10 CFR 50.55a, during the period of extended operation. The staff issued RAI B.2-2, dated June 5, 2008 requesting that the applicant clarify which edition of the ASME Code Section XI will be credited for those AMPs that credit the ASME Code Section XI during the period of extended operation. The staff’s review of RAI B.2-2 is documented in Section 3.0.3.2.1.

The staff reviewed the exception described in LRA Section B.2.4 and additional information provided by the applicant in RAI B.2-2 in its response dated July 21, 2008. The staff finds that the ASME Code Section XI, Subsection IWF, 1989 Edition with no Addenda, was the edition incorporated into 10 CFR 50.55a at the time the applicant was required to declare its inspection basis for the current 10-year IWF inspection interval.

The applicant's assurance to use ASME Code Section XI, 2001 Edition through 2002 and 2003 Addenda for the next ISI Intervals will assure its IWF program is consistent with GALL AMP XI.S3 during the period of extended operation. On this basis, the staff finds these exceptions acceptable.

The staff noted that the exception due to the use of ASME Code, 1989 Edition with no Addenda included the applicant's use of ASME Code Section XI Code Case N-491 as alternate rules for examination. However, in the "Operating Experience" program element, the applicant indicated that ASME Code Section XI, Subsection IWF, 1989 edition, Table IWF-2500-1 was used instead of ASME Code Section XI Code Case N-491, Table-2500-1.

In RAI B.2.4-1, dated May 8, 2008, the staff requested that the applicant clarify this issue and confirm the version of ASME Code Section XI, Code Case N-491 used in making its determination.

In its response to RAI B.2.4-1, dated June 16, 2008, the applicant stated that ASME Code Case N-491, Table-2500-1 should have been cited in the "Operating Experience" of LRA Section B.2.4 instead of ASME Code Section XI, IWF. The applicant revised the first paragraph of LRA Section B.2.4, "Operating Experience," to reference ASME Code Case N-491. The applicant further stated that the version of ASME Code Case N-491, used for the ASME Code Section XI, Subsection IWF Program, was Revision 0, dated March 14, 1991. The date listed in LRA Section B.3, "Appendix B References," is incorrect. The applicant also revised LRA Section B.3, Reference B.3-4 to provide the correct date.

Based on its review, the staff finds the applicant's response to RAI B.2.4-1 acceptable because the applicant has revised LRA Sections B.2.4 and B.3 to reflect the correct standards. Therefore, the staff concern described in RAI B.2.4-1 is resolved.

Operating Experience. The staff also reviewed the operating experience, including samples of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. In the application, the applicant explained that the operating experience of the ASME Code Section XI, Subsection IWF Program activities shows no adverse trend of program performance. The applicant also stated in the LRA that the ASME Code Section XI, Subsection IWF program for Units 1 and 2 has been updated to account for industry operating experience to maintain program quality. The applicant commenced periodic inspections in 2006 for Unit 1 and in 2003 for Unit 2 planned and every 10 years thereafter, for the duration of plant operation.

The staff's operating experience review concludes that the applicant's administrative controls are effective in detecting age-related degradation and initiating corrective action. The staff did not identify any age-related issues not bounded by the industry operating experience.

UFSAR Supplement. The applicant provided the UFSAR supplement for the ASME Code Section XI, Subsection IWF Program in LRA Section A.1.4. The staff reviewed this Section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. The staff reviewed the information provided in LRA Section B.2.4 and additional information provided by the applicant by letter dated June 16, 2008. The staff finds that those attributes of the applicant's ASME Code Section XI, Subsection IWF Program which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff has reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it.

Based on its review, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Closed-Cycle Cooling Water System Program

Summary of Technical Information in the Application. In LRA Section B.2.9, the applicant described the existing Closed-Cycle Cooling Water System Program as consistent, with enhancements, with GALL AMP XI.M21, "Closed-Cycle Cooling Water System."

The Closed-Cycle Cooling Water System Program includes preventive measures to minimize corrosion and periodic system and component performance testing and inspection to monitor the effects of corrosion, and confirm whether intended functions are met. This program manages loss of material, cracking, and reduction of heat transfer for components exposed to closed CWSs (*i.e.*, primary component and neutron shield tank cooling water, chilled water, diesel-driven fire pump engine cooling water (common), EDG cooling water, security diesel generator cooling water (common), emergency response facility substation diesel generator cooling water (common), and Unit 2 diesel-driven station standby air compressor engine cooling water).

These systems are closed cooling loops with controlled chemistry, consistent with the GALL Report description of a closed-cycle CWS. The program routinely confirms the adequacy of chemistry control by sampling to determine whether contaminants and additives are within established limits and by equipment performance monitoring for aging effects. These chemistry activities controlled by the applicant's procedures and processes are based on guidance for closed-cooling water chemistry in EPRI 1007820 (EPRI 107396, Revision 1).

Staff Evaluation. In LRA Section B.2.9, the applicant stated that the Closed-Cycle Cooling Water System Program is an existing program that is consistent with GALL Report AMP XI.M21, with enhancements.

The staff reviewed those portions of the applicant's Closed-Cycle Cooling Water System Program that the applicant claimed consistency with GALL AMP XI.M21 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program, as enhanced by the applicant, incorporated all the program elements of the referenced GALL AMP and that the conditions at the plant are bounded by those for which the GALL Report is evaluated. The staff also conducted onsite interviews with the applicant's technical staff to confirm these results.

The staff finds the applicant's Closed-Cycle Cooling Water System Program acceptable because it conforms to the recommended GALL AMP XI.M21, subject to the applicant's proposed enhancements. The staff evaluates these enhancements in the paragraphs and subsections that follow and provides its basis for concluding that the proposed enhancements will make the applicant's Closed-Cycle Cooling Water System Program consistent with the recommendations in GALL AMP XI.M21.

<u>Enhancement 1</u>. The applicant's program includes an enhancement to the "Scope of Program" program element of the AMP that states that components were added to the program for aging management (*i.e.*, diesel-driven fire pump Unit 1 only and diesel-driven standby air compressor Unit 2 only). During its review and audit, the staff noted that the scope of the Closed-Cycle Cooling Water System Program did not include all systems credited for in the Type 2 AMR tables of the LRA.

In RAI B.2.9-1, dated May 22, 2008, the staff requested that the applicant address the discrepancy between the systems identified as within the scope of the Closed-Cycle Cooling Water System Program and those that the AMP credits in the Type 2 AMR Tables of the LRA.

In its response to RAI B.2.9-1, dated July 24, 2008, the applicant stated that the text in LRA Section B.2.9, "Closed-Cycle Cooling Water," program description was intended to identify those systems that are a source of closed-cycle cooling water systems and not a list of those systems crediting the program to manage the effects of aging. The applicant further described although system interfacing components exist such as heat exchangers, that system is not necessarily a source of closed-cycle cooling water and is therefore not identified in LRA Section B.2.9.

The staff reviewed the applicant response and finds that the applicant has adequately explained the intent of the program description text which was not meant to identify each system with components that credit the program with aging management. Therefore the staff finds the response acceptable and the concern identified in RAI B.2.9-1 is closed.

<u>Enhancement 2</u>. The applicant also included an enhancement to the "Parameters Monitored/Inspected" program element of the AMP that states that the AMP will be enhanced to "detail performance testing of the heat exchangers and pumps and provide direction to perform visual inspections of system components." The staff noted that the "parameters monitored or inspected" program element in GALL AMP XI.M21 states that the parameters monitored for pumps in closed-cycle CWSs include system flow, discharge pressure, and suction pressure. Furthermore, the staff noted that for heat exchangers in closed-cycle CWSs, the parameters monitored or inspected include flow, inlet and outlet temperatures, and differential pressures.

In RAI B.2.9-2, dated May 22, 2008, the staff requested that the applicant explain whether the closed-cycle CWS pumps for the Unit 1 diesel driven fire pump and the Unit 2 diesel driven standby air compressor that the applicant added to the scope of this AMP (*i.e.*, Enhancement 1) are subject to the pump parameter monitoring identified above, and if not, why this is not identified as an exception to the recommendations in GALL XI.M21.

In its response to RAI B.2.9-2, dated July 24, 2008, the applicant stated that for the pump parameters, although the Unit 1 diesel driven fire pump and the Unit 2 diesel driven standby air compressor engines do not have installed instrumentation for all the parameters identified, the engines are provided with coolant temperature indications that permit monitoring and trending of the pump's function. The applicant further explained that the effectiveness of the cooling systems can be related to the installed engine temperature indication and therefore is not an exception to GALL Report Section XI.M21, "Closed-Cycle Cooling Water System." Additionally, the applicant explained that the parameters to be monitored and trended with respect to the closed-cycle cooling water pumps (system flow, discharge pressure, and suction pressure), are a recommendation of Revision 1 to EPRI 107396, which is now renumbered as EPRI 1007820, "Closed-Cooling Water Chemistry Guideline, Revision 1," which does not require installation of instrumentation if other parameters are available to monitor system performance. The applicant identified that the Closed-Cycle Cooling Water System Program in LRA Section B.2.9, was prepared using the EPRI 1007820 as referenced. Finally, the applicant explained that with the use of hand-held temperature instrumentation along with the installed instrumentation, system performance degradation will be monitored and trended as identified in the Program Enhancements.

The staff reviewed the applicant's response and finds that it adequately explained how the proposed enhancements to the Closed-Cycle Cooling Water System in LRA Section B.2.9 are consistent with the program in the GALL Report XI.M21. The applicant adequately explained that by using installed monitoring instrumentation along with hand-held instrumentation, the recommendations of both, XI.M21 and EPRI 1007820 are met and adequate monitoring will exist to confirm that the Closed-Cycle Cooling Water System AMP is effective in managing aging effects. Therefore, the staff's concern in RAI B.2.9-2 is resolved.

In RAI B.2.9-3, dated May 22, 2008, the staff similarly requested that the applicant explain whether closed-cycle CWS heat exchangers for the Unit 1 diesel driven fire pump and the Unit 2 diesel driven standby air compressor, added to the scope of this AMP are subject to the heat exchanger parameter monitoring identified above, and if not, why this is not identified as an exception to the recommendations of the recommendations in GALL XI.M21.

In its response to RAI B.2.9-3, dated July 24, 2008, the applicant stated that for the heat exchanger parameters, although the Unit 1 diesel driven fire pump and the Unit 2 diesel driven standby air compressor engines do not have installed instrumentation for all the parameters identified, the engines are provided with coolant temperature indications that permit monitoring and trending of the heat exchanger's function. The applicant further explained that the effectiveness of the cooling systems can be related to the installed engine temperature indication and therefore is not an exception to GALL Report Section XI.M21, Closed-Cycle Cooling Water System. Additionally, the applicant explained that the parameters to be monitored and trended with respect to the closed-cycle cooling water heat exchangers (temperature, flow, and differential pressure), are a recommendation of Revision 1 to EPRI 107396, which is now renumbered as EPRI 1007820, "Closed-Cooling Water Chemistry Guideline, Revision 1," and does not require installation of instrumentation if other parameters are available to monitor system performance. The applicant identified that the Closed-Cycle Cooling Water System Program in LRA Section B.2.9, was prepared using the EPRI 1007820 as referenced. Finally, the applicant explained that with the use of hand-held temperature instrumentation along with the installed instrumentation, system performance degradation will be monitored and trended as identified in the Program Enhancements.

The staff reviewed the applicant's response and finds that it adequately explained how the proposed enhancements to the Closed-Cycle Cooling Water System in LRA Section B.2.9 are consistent with the program in the GALL Report XI.M21. The applicant adequately explained that by using installed monitoring instrumentation along with hand-held instrumentation, the recommendations of both, XI.M21 and EPRI 1007820 are met and adequate monitoring will exist to confirm that the Closed-Cycle Cooling Water System AMP is effective in managing aging effects. Therefore, the staff's concern in RAI B.2.9-3 is resolved.

Enhancement *3.* The applicant also included an enhancement to the "detection of aging effects" program element of the Closed-Cycle Cooling Water Program that states that the AMP "will be enhanced to identify closed-cycle CWS parameters that will be trended to determine whether heat exchanger tube fouling or corrosion product buildup exists."

As previously stated, the staff reviewed the applicant's responses to RAI B.2.9-2 and B.2.9-3 and finds that it adequately explained how the proposed enhancements to the Closed-Cycle Cooling Water System in LRA Section B.2.9 are consistent with the program in the GALL Report XI.M21 for this program element.

The staff noted that the applicant's responses to RAI B.2.9-2 and RAI B.2.9-3 are relevant to the staff's evaluation of this enhancement because it is related to the identification of the performance monitoring parameters associated with the closed-cycle CWS pumps and heat exchangers for the Unit 1 diesel driven fire pump and the Unit 2 diesel driven standby air compressor, added to the scope of this AMP. On the basis that the issues in RAI B.2.9-2 and RAI B.2.9-3 are resolved, the staff finds this acceptable.

Enhancement 4*.* The applicant also included an enhancement to the "detection of aging effects" program element of the Closed-Cycle Cooling Water Program that states that the AMP "will be enhanced to control performance tests and to perform visual inspections at the required frequency."

Operating Experience. In LRA Section B.2.9, the applicant provided the following operating experience evaluation for BVPS:

> The Closed-Cycle Cooling Water System Program is an existing program that includes preventive measures to manage loss of material, cracking, and reduction of heat transfer for passive components which make up the closed-cycle cooling water (CCCW) systems.
>
> Multiple operating experience tools are used to assess, evaluate, and improve the management of passive aging of the CCCW systems. This includes Corrective Action Program documents, self assessments, quality assessment audits, latent issues reports, INPO operating experience documents (operating experience messages, Significant Event Reports, Significant Event Notifications, Significant Operating Experience Reports, etc.), and NRC documents (INs, Generic Letters, Bulletins, etc.). Corrective Action Program items or SAP Activity Tracking items will be used to track and document the site response to any internal or external document which is or may be applicable to BVPS.

A Self Assessment was performed on chemistry control of closed CWSs in March of 2007. There were two specific program improvement recommendations which were documented using the Corrective Action Program and will be tracked in SAP. The program improvements are (1) evaluating the feasibility of a corrosion coupon monitoring system and (2) determining if implementation of a sessile microbiological monitoring system provides a cost-justified benefit. Including these program recommendations into the Corrective Action Program and SAP Program will ensure that these potential improvements are tracked until it is determined whether or not to implement the proposed changes. The basis for either decision will be documented in the corrective report investigation summary. The integrity of the CCCW Systems is ensured by monitoring and maintaining water chemistry parameters within acceptable limits, and by inspecting the physical condition of system piping. Unexpected CCCW System conditions are addressed through the Corrective Action Program for resolution and to provide documented guidance for similar, future events (operating experience).

BVPS evaluated for applicability an INPO operating experience message regarding unexpected temperature control valve bolting corrosion in the Emergency Diesel Generator (EDG) Jacket Water System. The EDG at the affected plant was built by the same manufacturer as the BVPS Unit 2 EDGs. BVPS was also notified via the EDG owners group (Fairbanks-Morse), of which BVPS is an affiliated member. BVPS documented the assessment of this industry operating experience event in the Corrective Action Program, which provides tracking, documentation and an engineering basis for why no specific actions were needed.

The Closed Cycle Cooling Water System Program has been effective at managing aging effects for passive components which make up the closed cooling water systems. Use of corrective action process to identify, track, and document applicable operating experience events, and improvement recommendations from self-assessments, latent issues reports, and quality assessment audits provide reasonable assurance that the CCCW program, as enhanced, will effectively manage passive component loss of material, cracking, and reduction of heat transfer.

The staff reviewed LRA Section B.2.9 and noted that the applicant has identified examples of operating experience. The staff also noted that although unexpected temperature control valve bolting corrosion in the EDG jacket water system was included in the experience, no bolting was managed by the Closed-Cycle Cooling Water System Program.

In RAI B.2.9-4, dated May 22, 2008, the staff requested that the applicant explain where this bolting was described in the LRA and which program managed its aging effects.

In its response to RAI B.2.9-4, dated July 24, 2008, the applicant stated that the EDG jacket water system bolting is internal bolting which is not part of the valve body and; therefore, not subject to aging management in accordance with 10 CFR 54.21(a)(1)(i). The applicant further explained that this specific example of operating experience demonstrated an instance where industry operating experience was assessed. The applicant further stated that this example confirms that the program will be effective at managing aging effects for the period of extended operation, because it shows that the program evaluates industry operating experience.

The staff reviewed the applicant's response and finds that it adequately explained that this specific example of operating experience was not meant to be related to the Closed-Cycle Cooling Water System Program alone, but was included to demonstrate the breadth and scope of the operating experience researched because it included industry operating experience as well as plant-specific operating experience. On the basis that the temperature control valve internal bolting does not support the valve's pressure boundary intended function, the staff agrees that the bolting's aging management is not within the scope of the Closed-Cycle Cooling Water System Program. Therefore, the staff's concern in RAI B.2.9-4 is resolved.

UFSAR Supplement. The applicant provided the UFSAR supplement for the Closed-Cycle Cooling Water System Program in LRA Section A.1.9. The staff reviewed this Section and determines that the information in the UFSAR supplement provides an adequate summary description of the program consistent with the guidance found in the SRP-LR.

The staff reviewed the commitment list in LRA Section A, and confirms that the enhancements for Unit 1 are captured in LRA Table A4.1 (Commitment No. 2) and for Unit 2 in Table A5.1 (Commitment No. 2).

The staff determines that the information in the UFSAR Supplement provides an adequate summary description of the program as required by 10 CFR 54.21(d).

Conclusion. The staff reviewed the information provided in LRA Section B.2.9 and additional information provided by the applicant by letter dated July 24, 2008. Based on its review, the staff's acceptance of the applicant's Closed-Cooling Water System Program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 Fire Protection Program

Summary of Technical Information in the Application. In LRA Section B.2.16, the applicant described the Fire Protection Program as an existing program that is consistent with GALL Report AMP XI.M26, "Fire Protection," with enhancements and an exception. The applicant stated that this program is a condition monitoring and performance monitoring program, comprised of tests and inspections that follow the applicable National Fire Protection Association (NFPA) recommendations. The Fire Protection Program manages the aging effects on fire barrier penetration seals; fire barrier walls, ceilings and floors; fire wraps and fire rated doors (automatic and manual) that perform a CLB fire barrier intended function; diesel engine-driven fire pump fuel oil supply line; and Halon and carbon dioxide fire suppression systems.

Staff Evaluation. The staff reviewed those portions of the applicant's Fire Protection Program that the applicant claimed consistency with GALL AMP XI.M26 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant's technical staff to confirm these results.

The staff finds the applicant's Fire Protection Program acceptable because it conforms to the recommended GALL AMP XI.M26, with the enhancements and an exception as discussed below.

In comparing the elements in the applicant's Fire Protection Program to GALL AMP XI.M.26, the staff found that the applicant has taken enhancements as follows:

- Add into the "scope of program" element the fire protection systems that are within the scope of license renewal. The systems will also be included in the "detection of aging effects," monitoring and trending," and "acceptance criteria" elements.
- Enhance the inspection guidance to include details about fire barrier degradation.

The staff reviewed the enhancements and compared the changes with the GALL AMP XI.M26 recommendations for the enhanced elements. The staff determined that implementation of these enhancements will make the applicant's Fire Protection program consistent with the GALL AMP XI.M26. On this basis, the staff finds the enhancements acceptable.

In LRA Section B.2.16, the applicant stated that its Fire Protection Program is consistent with the GALL AMP XI. M26, however, the applicant claimed an exception to the "parameters monitored/inspected" element regarding frequency of functional testing for Halon and carbon dioxide systems. The applicant took this exception because it conducts the functional tests once every 18 months, which is less frequent than the GALL AMP XI.M26 guideline of at least one test for the detection of aging degradation every 6 months. The applicant also performs the Halon and carbon dioxide system inspections at 18-month intervals. However, to ensure the optimum integrity of the in-scope Halon and carbon dioxide systems, the applicant will inspect each system at least once every 6 months during the period of extended operation.

The staff reviewed UFSAR Sections 9.10.4 (Unit 1) and 9.5.1.7.4 (Unit 2) for CO_2 and Halon systems to determine if the CLB specified any frequency of inspections. The staff found that the UFSAR only states that in-service inspection and testing will be periodically performed. Since the CLB does not specify any frequency for inspections, the staff determined that additional information was required to complete the review.

In RAI B.2.16-3, dated May 22, 2008, the staff requested that the applicant provide the bases for using a different inspection frequency than the recommended GALL AMP XI.M26 frequency of once every six months.

In its response to RAI B.2.16-3, dated July 24, 2008, the applicant stated that the UFSAR for Units 1 and 2 described the testing and inspection of the fire protection system as conducted in accordance with BVPS administrative procedures. The applicant further stated that plant operating experience indicates that the 18-month testing frequency is adequate to provide assurance that the systems will continue to perform their intended functions during the period of extended operation.

The staff reviewed the applicant response and noted that the applicant referenced the BVPS Administrative Procedures; which is where the applicant defines the current licensing basis testing frequencies. The staff reviewed the plant operating experience and noted that there was no age related degradation identified for the Halon and carbon dioxide systems. On the basis that the applicant is performing functional tests in accordance with its current licensing basis, and conducts visual inspections once every six months, and based on the plant operating experience, the staff finds that these inspection and testing frequencies are adequate to ensure the system maintains its function and finds the exception acceptable.

The above exception also implied that the applicant will enhance the Fire Protection Program to change the frequency of Halon and carbon dioxide system inspections from once every 18 months to once every six months. However, the applicant has not identified an enhancement for this change nor made a commitment in the application.

The staff issued RAI B.2.16-1, dated May 22, 2008, requesting that the applicant justify why this enhancement has not been identified in LRA Section B 2.16.

In its response to RAI B.2.16-1, dated July 24, 2008, the applicant stated that this enhancement is identified in LRA Section B.2.16, Table A.4-1 (Item 7) and Table A.5-1 (Item 8). However, the staff determined that the applicant's wording of the enhancement and the commitment are too general in that they do not specifically state that the Fire Protection Program will be enhanced to change the inspection frequency to once every six months. Therefore, the staff requested the applicant via conference call dated November 17, 2008, to be more specific in the enhancement and the commitment.

In its letter dated December 11, 2008, in response to the follow-up RAI, the applicant modified Section B.2.16, Commitment No. 7 in Table A.4-1 and Commitment No. 8 in Table A.5-1 to clarify that the inspection frequency of Halon and carbon dioxide systems will be changed to at least once every six months.

The staff reviewed the applicant response and the changes to the commitment list; and finds the response acceptable based on revision to the commitment words to specifically include change in inspection frequency of Halon and carbon dioxide systems to once every six months.

Operating Experience. The staff reviewed the applicant's operating experience described in the LRA and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff also confirmed that the applicant has reviewed applicable aging effects and industry and plant-specific operating experience and are evaluated in the GALL Report. In addition, the staff confirmed that the applicant has addressed operating experience identified after issuance of the GALL Report.

The staff also reviewed the applicant's "operating experience" discussion provided in the license renewal basis document for the Fire Protection Program. Examples of operating experience involve missing or damaged fire seals on fire doors, roll-up doors, shake spaces, and wall penetrations which were identified during 2001-2006. Discrepancies in fire barrier wrappings were detected by the applicant during periodic surveillances in 2003. The staff reviewed a sample of condition reports and confirmed that the applicant had identified age-related degradation of fire protection components and implemented appropriate corrective actions.

The staff finds that the applicant's Fire Protection Program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and correcting the effects of age related degradation in fire protection systems and can be expected to ensure that the systems and components within the scope of this program will continue to perform their intended functions, consistent with the CLB for the period of extended operation.

UFSAR Supplement. The applicant provided the UFSAR supplement for the Fire Protection Program in LRA Section A1.16. The staff verified that the UFSAR supplement summary description for the Fire Protection Program conformed to the staff's recommended UFSAR supplement for these types of programs described in SRP-LR Table 3.3-2. The staff determined that the information in the UFSAR supplement is not sufficiently comprehensive. The UFSAR supplement states that the program manages the aging effects; however, it does not state how it manages the aging effects.

SRP-LR Section 3.3.2.4, FSAR supplement, states that the summary description of the programs and activities for managing the effects of aging for the period of extended operation in the FSAR supplement should be sufficiently comprehensive such that later changes can be controlled in by 10 CFR 50.59. The description should contain information associated with the bases for determining that aging effects will be managed during the period of extended operation.

In RAI B.2.16-2, dated May 22, 2008, the staff requested that the applicant provide a more comprehensive UFSAR supplement summary for the Fire Protection Program.

In its response to RAI B.2.16-2, dated July 24, 2008, the applicant revised the UFSAR summary description to include additional detail on how the program manages aging effects, such as periodic inspections of fire barriers, operational testing of diesel-engine driven fire pump, and functional testing and inspection of Halon and carbon dioxide systems.

The staff reviewed the revised UFSAR supplement summary descriptions and finds that the revised UFSAR supplement summary description for the Fire Protection Program conforms to the staff's recommended UFSAR supplement for the Fire Protection Program described in SRP-LR Table 3.3-2. The staff reviewed the commitment list in LRA Section A and confirmed that the enhancements for Unit 1 are captured in Table A4.1 (Commitment No. 7) and for Unit 2 in Table 5.1 (Commitment No. 8).

Based on this review, the staff finds that the FSAR Supplement Section A.1.16 provides an acceptable FSAR supplement summary description of the applicant's Fire Protection Program. Therefore, the staff's concern described in RAI B.2.16-2 is resolved.

Conclusion. The staff reviewed the information provided in LRA Section B.2.16 and additional information provided by the applicant by letters dated July 24, 2008 and December 11, 2008. Based on its review, the staff finds the applicant's Fire Protection Program acceptable because it is consistent with the GALL Report with enhancements and exception, and the plant is bounded by the conditions set forth in the GALL Report for this AMP. The staff also finds that the Fire Protection Program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the revised UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 Fire Water System Program

Summary of Technical Information in the Application. In LRA Section B.2.17, the applicant described the Fire Water System Program as an existing program that is consistent with GALL Report AMP XI.M27, "Fire Water System," with enhancements. The applicant stated that program activities include periodic inspection and hydro-testing of hydrants and hose stations, sprinkler head inspections, and system flow tests.

Staff Evaluation. The staff reviewed those portions of the applicant's Fire Water System Program that the applicant claimed consistency with GALL AMP XI.M27 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant's technical staff to confirm these results.

The staff finds the applicant's Fire Water System Program acceptable because it conforms to the recommended GALL AMP XI.M27, with the enhancements as discussed below.

In comparing the elements in the applicant's AMP to GALL AMP XI.M27, the staff found that the applicant has taken enhancements as follows:

- Added a program requirement in the "Parameters monitored/inspected" to perform flow test or inspection of all accessible fire water headers

- Added program requirements in the "detection of aging effects" element to identify locations if visual inspections are to be performed; allow test or inspection results from accessible Section of pipe to be extrapolated for inaccessible pipe; all accessible headers and piping to be flow tested; and require testing or replacement of sprinkler heads in service for 50 years.

The staff reviewed the enhancements and compared the changes with the GALL AMP XI.M27 recommendations for the enhanced elements. The staff determined that implementation of these enhancements will make the applicant's Fire Water System Program consistent with the GALL AMP XI.M27. On this basis, the staff finds the enhancements acceptable.

The applicant also included an enhancement in the "detection of aging effects" element that states that the program enhancement described under the "scope of program" element is necessary. However, there is no enhancement identified in the "scope of program" element.

In RAI B.2.17-1, dated May 22, 2008, the staff requested that the applicant clarify this discrepancy.

In its response to RAI B.2.17-1, dated July 24, 2008, the applicant stated that the reference to "scope of program" element was an error and that there is no enhancement in the "scope of program" element.

The subject sentence should have referenced the “parameters monitored/inspected” element. The staff noted that the applicant has revised LRA Section B.2.17, 5th paragraph, under subheading “Detection of Aging Effects” as follows:

> Also, the program enhancement described under the Parameters Monitored/Inspected program element is necessary for consistency with this program element.

Based on its review, the staff finds the applicant’s response to RAI B.2.17-1 acceptable because the applicant has revised LRA Section B.2.17 to make the enhancement wording consistent with this program element. Therefore, the staff’s concern described in RAI B.2.17-1 is resolved.

During the review of the Fire Water System Program basis document, the staff noted that the applicant states that the Unit 1 fire hydrant gasket inspection is performed every 18 months, compared to the GALL AMP recommendation of 12 months. However, the staff determined that the applicant did not include this as an exception in the LRA because gaskets were considered consumables and will be replaced as necessary.

In RAI B.2.17-2, dated May 22, 2008, the staff requested that the applicant justify the basis for this excluding the 18 month Unit 1 fire hydrant gasket inspection as an exception to the 12 month recommendation of the GALL AMP.

In its response to RAI B.2.17-2, dated July 24, 2008, the applicant stated that based on ANSI B31.1 and the ASME Code Boiler and Pressure Vessel Code, Section III, the subcomponents of pressure retaining components are not pressure retaining parts. Therefore, these subcomponents are not relied on to form a pressure-retaining function and are not subject to an AMR. The applicant further stated that although these gaskets perform no license renewal intended function, their condition is monitored by the Fire Water System Program and they are replaced as necessary.

The staff reviewed the response and noted that the condition of the fire hydrant gaskets is monitored by the Fire Water System Program and the gaskets are replaced as necessary. However, the GALL AMP recommended frequency for these gaskets is once a year whereas the applicant performs these inspections once every 18 months. The staff determines that the applicant’s response does not address why this is not an exception. Therefore, the staff issued a follow-up RAI by letter dated September 3, 2008, requesting that the applicant justify the basis for this excluding the 18 month Unit 1 fire hydrant gasket inspection as an exception to the 12 month recommendation of the GALL AMP.

In its letter dated October 3, 2008, in response to the follow-up RAI the applicant stated that because the gaskets are considered consumables which are replaced on condition following inspection, the applicant did not consider the difference in gasket inspection frequency to be an exception. Operating experience has shown that the 18 month frequency is adequate to provide reasonable assurance that the fire hydrants can perform their intended function.

SRP-LR Table 2.1-3 provides specific staff guidance on screening of consumables. The SRP-LR states that gaskets are subcomponents and are not relied on for pressure boundary and could be excluded from aging management review.

On the basis that the gaskets perform no license renewal function, are replaced on condition following inspection, and operating experience has shown that the frequency is adequate to maintain component intended function, the staff finds that the difference in inspection frequency between the GALL AMP and the applicant program does not need to be an exception. Therefore, the staff finds the response acceptable and considers the issue closed.

During the review of the Fire Water System Program basis document, the staff noted that the applicant stated that fire hydrant hose hydraulic tests are performed at frequencies different than the GALL AMP recommended frequency of once every 12 months. However, the applicant did not include this as an exception in the LRA because hoses were considered consumables and would be replaced as necessary.

In RAI B.2.17-3, dated May 22, 2008, the staff requested that the applicant justify why this frequency difference is not an exception.

In its response to RAI B.2.17-3, dated July 24, 2008, the applicant stated that fire hoses are consumables, and are routinely tested, inspected, and replaced when necessary. Criteria for inspection and replacement are based on accepted industry standards (*e.g.*, NFPA-1962). The applicant further stated that while these consumables are within the scope of license renewal, they do not require an AMR.

The staff reviewed the applicant's response and acknowledges that the condition of the fire hydrant hoses is monitored by the Fire Water System Program and the hoses are replaced as necessary. However, the GALL AMP recommended frequency for hydraulic testing of hoses is once a year, whereas the applicant performs these tests at various frequencies and its response to the RAI does not address why this test frequency is not an exception. Based on its review, the staff finds the applicant's response not acceptable. Therefore, the staff issued a follow-up RAI by letter dated September 3, 2008, requesting that the applicant justify why this is not an exception.

In its letter dated October 3, 2008, in response to the follow-up RAI, the applicant responded that hoses are considered consumable items which are replaced on condition following inspections. Since they are not subject to aging management review, the difference in frequency was not considered an exception.

SRP-LR Table 2.1-3 provides specific staff guidance on screening of consumables. The SRP-LR states that for fire hoses are typically replaced based on performance or condition monitoring and may be excluded on a plant from aging management review. However, the standards that are relied upon for the replacement should be part of the methodology description. The staff reviewed LRA Section 2.1.2.4.3 that explains the applicant's methodology for treatment of consumables such as fire hoses, and states that criteria for inspection and replacement are based on accepted industry standards (e.g., Branch Technical Position BTP-APCSB 9.5-1, NFPA-10 for fire extinguishers, and NFPA-1962 for fire hoses. On the basis that the applicant has provided the criteria for replacement of fire hoses in accordance with the staff guidance in SRP-LR Table 2.1-3, the staff concurs that fire hoses are consumables and therefore, finds that the difference in inspection frequency between the GALL AMP and the applicant program does not need to be an exception. The staff finds the applicant response to be acceptable and considers the issue closed.

Operating Experience. The staff reviewed the operating experience provided in the LRA and in the applicant's operating experience basis document and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience did not reveal any aging effects not bounded by the GALL Report. The staff also confirmed that applicable aging effects and industry and plant-specific operating experience have been reviewed by the applicant and are evaluated in the GALL Report. Furthermore, the staff confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report.

The staff also reviewed the applicant's "operating experience" discussion in the license renewal basis document for the Fire Water System Program. The staff noted that several corrective reports were generated to address pinhole leaks in fire protection piping. The cause of the leaks was identified as loss of material due to MIC. In Corrective Report 05-3940, the applicant determined that the chemical treatment of the piping did not eliminate MIC already established in the piping. The applicant confirmed by UT inspections that areas in the piping system had a wall thickness loss of 50% or more.

In RAI B.2.17-4, dated May 22, 2008, that staff requested that the applicant identify what preventive measures have been taken to address this issue and whether those measures were adequate.

In its response to RAI B.2.17-4, dated July 24, 2008, the applicant stated that the 2005 condition report indicates that further chemical treatment at that time would not have eliminated the MIC in the piping welds. Because of the large number of potentially susceptible welds in the piping, the applicant replaced the entire length of affected pipe. The applicant also stated that continuing chemical treatments, testing, and inspection of the new pipe provide reasonable assurance that MIC will be adequately managed prior to loss of intended function.

The applicant also stated that testing of the fire water system is performed in accordance with applicable NFPA codes and standards, including testing requirements associated with the fire suppression water system, spray and sprinkler system, and fire hose stations. The fire water systems are normally maintained at required operating pressure and monitored such that loss of system pressure is immediately detected and corrective actions initiated. The applicant explained that ultrasonic tests are capable of effectively evaluating pipe wall thickness and inner diameter. The applicant further stated that continuing chemical treatments, testing, continuous pressure monitoring, inspections (including UT), incorporation of site-specific operating experience, and evaluation of degradation using the Corrective Action Program, provide reasonable assurance that the fire water system's intended functions will be maintained for the period of extended operation.

Based on its review, the staff finds that applicant's response to RAI B.2.17-4 acceptable because the applicant has verified that chemical treatment would not have eliminated the MIC that was already established in the piping welds. The staff further finds that the applicant has taken appropriate corrective action to replace the affected pipe. The staff concludes that chemical treatment will ensure that MIC is minimized in the new pipe and that periodic testing, continuous pressure monitoring, inspections and UT will provide assurance that the Fire Water System Program will adequately manage aging. Therefore, the staff's concern described in RAI B.2.17-4 is resolved.

The staff finds that the applicant's Fire Water System Program has been effective in identifying, monitoring, and correcting the effects of age related degradation in fire water systems and can be expected to ensure that the systems and components within the scope of this program will continue to perform their intended functions consistent with the CLB for the period of extended operation.

UFSAR Supplement. The applicant provided the UFSAR supplement for the Fire Water System Program in LRA Section A.1.17. The staff verified that the UFSAR supplement summary description for this AMP conforms to the staff's recommended UFSAR supplement described in SRP-LR Table 3.3-2. The staff determines that the information in the UFSAR supplement provides an adequate summary description of the program consistent with the SRP-LR.

The staff reviewed the commitment list in LRA Section A, and confirms that the enhancements for Unit 1 are captured in Table A4.1 (Commitment Number 8) and for Unit 2 in Table A5.1, (Commitment Number 9).

Based on its review, the staff finds that FSAR Supplement Section A.1.17 provides an acceptable FSAR Supplement summary description of the applicant's Fire Water System Program.

Conclusion. The staff reviewed the information provided in LRA Section B.2.16 and additional information provided by the applicant by letters dated July 24 and October 3, 2008. Based on its review, the staff finds the applicant's Fire Water System Program acceptable because it is consistent with the GALL Report with enhancements, and the plant is bounded by the conditions set forth in the GALL Report for this AMP. The staff finds that the program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 Flux Thimble Tube Inspection Program

Summary of Technical Information in the Application. In LRA Section B.2.19, the applicant described the Flux Thimble Tube Inspection Program. This program will identify loss of material due to wear prior to leakage, by monitoring for and predicting wall thinning in the movable incore detector system flux thimble tubes. The program achieves this through the use of periodic NDE and extrapolation of data to determine the tube wall thinning progression. The program uses the extrapolated data to take preemptive action to reposition, replace or isolate the affected thimble tube prior to loss of intended function.

Staff Evaluation. In the LRA, the applicant stated that the Flux Thimble Tube Inspection Program is an existing program that is consistent with GALL AMP XI.M37, "Flux Thimble Tube Inspection," with an enhancement. The enhancement includes corrective actions which would require removal of a thimble tube from service if it cannot be inspected over the tube length.

During its audit, the staff reviewed the applicant's onsite documentation used to support its conclusion that the program elements are consistent with the elements in the GALL Report.

The staff conducted onsite interviews with the applicant's technical staff to confirm these results.

In comparing the elements in the applicant's program, the staff found that the GALL Report "parameters monitored and inspected" and "detection of aging effects" program elements require a wear limit, but the applicant did not include a full history of the change approval.

In RAI B.2.19-1, March 26, 2008, the staff requested that the applicant provide a full history of the change approval.

In its response to RAI B.2.19-1, dated April 25, 2008, the applicant stated that in a memorandum dated August 1, 1989, the NRC acknowledged that the flux thimble tube wear limits were subject to potential future changes. Further, the applicant stated that since the original wear limit calculation was instituted, advancements have been made on improved eddy current test methods that decrease the uncertainty value, and that a Westinghouse Owners Group program was developed to manage the effects of flux thimble tube wear. The applicant stated that the current wear limit utilizes the wear limit guidance from this Westinghouse Owners Group program.

Based on its review, the staff finds the applicant's response to RAI B.2.19-1 acceptable because the applicant has adequately explained the history of the change approval and has verified the past performance of its flux thimble tube inspection program and the basis for the wear limit change. Therefore, the staff's concern described in RAI B.2.19-1 is resolved.

In LRA Section B.2.19, the applicant stated that an enhancement to the GALL Report "corrective actions" program element includes corrective actions which would require removal of a thimble tube from service, if it cannot be inspected over the tube length. The staff finds this enhancement acceptable because, when implemented, the Flux Thimble Tube Inspection Program will be consistent with GALL AMP XI.M37 and will add assurance of adequate management of aging effects.

The staff also reviewed the operating experience reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. In one report, the applicant stated that an elevated wall thinning rate was experienced in 2003, but was deemed acceptable due to industry experience. However the specific industry experience was not found at the time of the audit.

In RAI B.2.19-2, March 26, 2008, that staff requested that the applicant provide information on the industry experience that led to the decision that the elevated thinning rate was acceptable.

In its response to RAI B.2.19-2, dated April 25, 2008, the applicant stated that the wear for the two thimble tubes, initially showing elevated wear rates, was projected by Westinghouse to determine the expected timeframe for reaching the program maximum wear limit. The applicant repositioned the two thimble tubes in a subsequent RFO, prior to the projected wear limit. Additionally, the applicant supplied the actual wear measurements data, which supported their claim that the projections were conservative, and that the thimble tubes were not at risk of surpassing the maximum wear limit.
Based on its review, the staff finds the applicant's response to RAI B.2.19-2 acceptable because the applicant has provided an adequate summary of specific industry experience supporting its basis for concluding that the wall thinning rate was acceptable. The staff confirms that the

applicant has supplied wear measurement data, has repositioned the two thimble tubes, and has completed a history of projections. Therefore, the staff's concern described in RAI B.2.19-2 is resolved.

UFSAR Supplement. The applicant provided the UFSAR supplement for the Flux Thimble Tube Inspection Program in LRA Section A.1.19. The staff reviewed this Section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The applicant committed (Commitment Nos. 9 (Unit 1) and 10 (Unit 2)) to implement this program before the period of extended operation.

Conclusion. The staff reviewed the information provided in LRA Section B.2.19 and additional information provided by the applicant by letter dated April 25, 2008. Based on its review, the staff concludes that the applicant has demonstrated that effects of aging on flux thimble tubes will be adequately managed so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.2.8 Fuel Oil Chemistry Program

Summary of Technical Information in the Application. In LRA Section B.2.20, the applicant described the existing Fuel Oil Chemistry Program as consistent, with exceptions and enhancements, with GALL AMP XI.M30, "Fuel Oil Chemistry."

The mitigating and condition-monitoring Fuel Oil Chemistry Program manages aging effects of the internal surfaces of oil storage tanks and system components that contain diesel fuel oil. The program includes: (a) monitoring to maintain diesel fuel oil quality by contaminant control in accordance with ASTM D975, D1796, D2276 and D4057; (b) periodic sampling of fuel oil tank content and new fuel oil shipments for water and contaminants and draining of any accumulated water from the tanks; (c) sampling of fuel oil tank content and new fuel oil shipments for sediment, viscosity, and flash point; and (d) periodic or conditional visual inspecting of internal surfaces or measuring of wall thickness (*e.g.*, UT) of tanks. The One-Time Inspection Program will verify the effectiveness of the Fuel Oil Chemistry Program.

Staff Evaluation. In LRA Section B.2.16, the applicant stated that the Fuel Oil Chemistry Program is an existing program that is consistent with GALL Report AMP XI.M30, Fuel Oil Chemistry with enhancements and exceptions.

The staff reviewed those portions of the applicant's Fuel Oil Chemistry Program that the applicant claimed consistency with GALL AMP XI.M30 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. Onsite interviews were also held to confirm these results.

The staff finds the applicant's Fuel Oil Chemistry Program acceptable because it conforms to the recommended GALL AMP XI.M30, Fuel Oil Chemistry. The staff's review of the enhancements of the AMP and exceptions in the AMP that are taken against the program elements in GALL AMP XI.M30 are evaluated in the subsections that follow.

Enhancements. In comparing the elements in the applicant's AMP, the staff found that the applicant has taken enhancements as follows:

(1) Add into the "Parameters Monitored/Inspected" element, revised procedures for sampling and testing the diesel-driven fire pump fuel oil storage tank (Unit 1) which includes a particulate and accumulated water test. Additionally, a new implementing procedure will be issued that describes sampling and testing the security diesel generator fuel oil day tank (Common) for accumulated water, particulate contamination, and sediment/water.

(2) The "Detection of Aging Effects" describe that the enhancements under "Parameters Monitored/Inspected" element bring the Fuel Oil Chemistry Program into consistency with the GALL AMP.

As a result of the staff's IP-71002 inspections that occurred during the weeks of June 23 and July 14, 2008, the applicant identified necessary revisions to the LRA which includes a new program enhancement. The applicant provided the program changes in letter L-08-262 dated, September 8, 2008 which includes LRA Amendment No. 23.

(3) The "Detection of Aging Effects" describe that implementing procedures will be revised to perform UT thickness measurements of accessible above-ground fuel oil tank bottoms at the same frequency as tank cleaning and inspections to ensure that significant degradation is not occurring.

By letter dated October 2, 2008, the applicant identified necessary revisions to the BVPS LRA which includes an additional new program enhancement. This letter described LRA Amendment 26, resulting from the findings of the staff's IP-710002 inspections that occurred during the weeks of June 23 and July 14. The following is the staff's evaluation of the enhancements.

(4) The "Detection of Aging Effects" describe that for inaccessible tank bottoms, appropriate NDE techniques will be used to determine tank bottom thickness, if inspections indicate the presence of significant corrosion.

The staff reviewed the enhancements and compared the changes with the GALL AMP XI.M30 recommendations for the enhanced elements. The staff determined that implementation of these enhancements will make the applicant's Fuel Oil Chemistry program consistent with the GALL AMP XI.M30. The applicant adopted the more restrictive requirements of those fuel oil tanks subject to Technical Specification Requirements to the non-Technical Specification fuel oil tanks. Additionally, the administrative control requirements in Technical Specification (TS) 5.5.9 have been applied for all the fuel oil tanks within the scope of the program. On this basis, the staff finds the enhancements acceptable.

Exception 1. In the LRA, the applicant identified the following exception to the "Scope of Program," "Parameters Monitored/Inspected," "Monitoring and Trending," and "Acceptance Criteria" program elements in GALL AMP XI.M30:

> BVPS does not use ASTM standard D2709. BVPS uses ASTM D1796 versus ASTM D2709 for guidance on the determination of water and sediment contamination. The use

> of ASTM D1796, with an acceptance criterion for water and sediment content of less than or equal to 0.05% is required by BVPS Technical Specification Surveillance Requirements.

The staff verified that the implementation of applicant's Fuel Oil Chemistry Program, as implemented relative to the emergency diesel generator system, is based on the applicant's administrative control requirements for diesel fuel oil testing that are provided in Technical Specification (TS) 5.5.9, which requires API gravity or absolute specific gravity testing, flash point and viscosity testing, and water and sediment testing of all new, procured fuel oil prior to adding the new oil inventories to the diesel fuel oil tanks, and API gravity or absolute specific gravity testing, flash point and viscosity testing, water and sediment testing, and particulate testing on existing fuel oil inventories in the tanks at least once every 31 days.

In RAI B.2.20-2, the staff asked the applicant to provide a summary of the evaluation for the use of ASTM Standard D1796 and to identify specific fuel oil tanks whose diesel fuel oil inventories are subject to the TS testing requirements.

In its response dated July 24, 2008, the applicant stated that since the use of ASTM D1796 is also recommended by NUREG-1801, XI.M30 and has been reviewed be the NRC staff therefore no further evaluation is required. The applicant stated that both standards outline test methods for determining water and sediment concentration by centrifuge. Further, the applicant identified that, the use of ASTM D1796 is required by BVPS Technical Specifications. Finally, the applicant stated that through the program enhancements identified above, water and sediment testing is applied to all tanks within the scope of the program, in addition to just the safety-related tanks.

The staff reviewed the applicant's response and finds that it adequately explains the reasons for using ASTM D1796 instead of D2709. The staff also reviewed the BVPS Unit 1 and 2 Technical Specifications 3.8.1, 3.8.3, Surveillance Bases 3.8.3.3.d, ASTM D1796, and ASTM D2709. The Surveillance Bases require ASTM D1796 be used to satisfy Surveillance Requirement 3.8.3.3.d in verifying that the new fuel oil has water and sediment content of less than or equal to 0.05%. On this basis, the staff finds this exception acceptable because it adequately explains that the Technical Specification Surveillance Requirements specify ASTM D1796 and that this ASTM Standard is identified in the TS bases 5.5.9, "Diesel Fuel Oil Testing Program," and because the applicant has clarified that it applies the required testing to all diesel fuel oil tanks within the scope of the program. Therefore, the staff's concern in RAI B.2.20-2 is resolved.

<u>Exception 2</u>. In the LRA, the applicant identified the following exception to the "Scope of Program," "Parameters Monitored / Inspected," "Monitoring and Trending," and "Acceptance Criteria" program elements in GALL AMP XI.M30:

> BVPS does not use ASTM standard D 6217. BVPS uses ASTM D 2276 versus ASTM D 6217 for guidance on the determination of particulate contamination. The use of ASTM D 2276, with an acceptance criterion of a total particulate contamination of less than 10 mg/liter, is required by BVPS Technical Specification Surveillance Requirements.

The staff reviewed the BVPS Unit 1 and 2 Technical Specifications 3.8.1, 3.8.3, Surveillance Bases 3.8.3.3, ASTM D6217, and ASTM D2276. The Surveillance Bases require ASTM D2276 be used to satisfy Surveillance Requirement 3.8.3.3 in verifying that the new fuel oil has a particulate concentration of less than or equal to 10 mg/l. Additionally, ASTM D2276 is used for determination of particulate contamination for all diesel fuel oil tanks within the scope of the program. On this basis, the staff finds this exception acceptable because it adequately explains that the Technical Specification Surveillance Requirements specify ASTM D2276 and that the testing requirement ASTM Standard is identified in Technical Specification 5.5.9, "Diesel Fuel Oil Testing Program."

Exception 3. In the LRA, the applicant identified the following exception to the "Parameters Monitored/Inspected" program element in GALL AMP XI.M30:

> BVPS does not use a filter with a pore size of 3.0 microns when testing fuel oil for particulates. BVPS will continue to use the 0.8 micron pore size filter recommended by ASTM D2276 (which is required by BVPS Technical Specification Surveillance Requirements). Use of a filter with a smaller pore size results in a larger sample of particulates because smaller particles are retained. Thus, use of a 0.8 micron filter is more conservative than use of a 3.0 micron filter.

In RAI B.2.20-3, the staff asked the applicant to provide the evaluation and basis for using the 8 micron filter instead of the 3.0 micron filter in determining fuel oil particulates. Additionally, the staff asked the applicant to identify the specific fuel oil tanks subject to testing for particulates.

In its response dated July 24, 2008, the applicant stated that the Technical Specifications require the guidance of ASTM D2276-78 without modification for filter pore size. The smaller filter size generates a more conservative test for particulates than the larger recommended size, providing assurance that fuel oil systems are adequately managed for the period of extended operation. Finally, the applicant stated that through the program enhancements identified above, the smaller filter pore size is applied to all tanks within the scope of the program, in addition to just the safety-related tanks.

The staff reviewed the applicant's response and finds it adequately identified that the use of the smaller filter pore size is more conservative in testing for particulates than the 3.0 micron filter pore size. Further, the staff agrees that the Technical Specifications require the use of the smaller pore size. Therefore, the staff's concern in RAI B.2.20-3 is resolved.

Exceptions 4 and 5. In the LRA, the applicant identified the following exception to the "Preventative Actions," program element in GALL AMP XI.M30:

> Biocides, stabilizers, and corrosion inhibitors, are not used at BVPS. A recent review, documented using the Corrective Action Program, evaluated the possibility of using fuel oil additives, and determined that additives would not provide any significant benefit and thus were not recommended for use at BVPS. Results from "for-cause" testing, performed in response to Corrective Action Program reports written when excessive sediment was detected within a fuel oil system, indicate that microbiological activity has not been a problem in any fuel oil subsystem at BVPS. Due to the materials of construction and a lack of water in the fuel oil tanks, there is also no benefit to the addition of corrosion inhibitors or metal deactivators to the fuel oil.

In addition, the LRA identified the following exception to the “Detection of Aging Effects,” and Monitoring and Trending” program elements in GALL AMP XI.M30:

> BVPS does not routinely sample fuel oil for microbiological organisms. BVPS monitors for corrosion products and sediment; if detected, BVPS will evaluate the need for further laboratory analysis to detect the presence of microbiological organisms or by-products.

Both of the exceptions pertain to the question on whether the applicant needs to monitor for microbiological organisms in the diesel fuel oil inventories or add microbiological growth inhibitors (biocides) in the diesel fuel oil inventories. The staff reviewed the BVPS UFSAR Section 9.14 for Unit 1 and Section 9.5.2 for Unit 2 for diesel fuel oil storage systems. The staff noted that these UFSAR sections do not mention that the material of construction for the fuel oil storage tanks are resistant to microbiologically induced corrosion. Therefore the staff issued RAI B.2.20-1 dated May 22, 2008, requesting the applicant provide justification for taking these exceptions.

In its response dated July 24, 2008, the applicant explained the exception of using biocides due to the materials of tank construction. The explanation included an evaluation weighing the use of biocides, stabilizers, and corrosion inhibitors in the Emergency Diesel Generator fuel oil tanks. The applicant further explained that the evaluation found that biocides were not needed because testing found no evidence of microorganisms in the tanks, corrosion inhibitors were not necessary due to the lack of water in the tanks, and metal deactivators were not necessary due to the materials of tank construction. The applicant identified all the fuel oil tank systems for which the Fuel Oil Chemistry Program is credited with managing their aging effects. Additionally, the applicant stated the material of construction for each tank. In summary, of the ten tanks identified nine are carbon steel and one is fiberglass. The applicant stated that although there was no evidence for the need of biocides, fuel stabilizers, or corrosion inhibitors, a sampling schedule for the diesel generator fuel tanks that determines concentrations of water and/or particulates in a timely manner. The applicant also stated that such analyses will minimize tank loss of material and that the sampling frequency is based on plant-specific operating experience. The history has shown relatively few instances of particulate levels exceeding the Technical Specifications limit. The applicant explained that particulate testing will provide indication of corrosion byproducts and microbiological growth.
The Fuel Oil Chemistry Program provides for the use of fuel oil additives via the Corrective Action Program if analysis results warrant their use due to out of specification conditions and the existence of adverse trends. Finally, the applicant stated that the effectiveness of the Fuel Oil Chemistry Program is verified by the One-Time Inspection Program.

The staff reviewed the applicant’s response and finds that it adequately explained how the proposed exception from the Fuel Oil Chemistry Program in LRA Section B.2.20 is acceptable. The staff finds that with the sampling frequency established by plant-specific operating experience and the particulates limits set by the Technical Specifications for the diesel generator fuel oil tanks, the Fuel Oil Chemistry Program would be effective in managing the aging effects due to loss of material. Further, the staff agrees that the particulate analysis would be an indication of microorganisms which would then be documented, evaluated, and trended in the Corrective Action Program, if found to be out of specification. The staff finds that the One-Time Inspection would be adequate to verify the effectiveness of the Fuel Oil Chemistry Program because it provides for visual inspections or NDE of internal tank surfaces. Thus, based on this assessment, the staff finds that the applicant has provided an acceptable basis for deferring its determination on whether the fuel oil needs to be monitored for microbiological because the operating experience at the plant to date has not indicated that biological organism presence and growth is a problem for the diesel fuel oil stored at the plant and because the applicable will use its One-Time Inspection Program of the diesel fuel oil inventories to determine whether biological organisms are present in the diesel fuel oil inventories and needs to be managed for the period of extended operation.

Exception 6. By letter L-08-262 dated October 2, 2008, the applicant identified necessary revisions to the BVPS LRA which includes an additional program exception to the program element, "Detection of Aging Effects." This letter described LRA Amendment 26, resulting from the findings of the staff's IP-71002 inspections that occurred during the weeks of June 23 and July 14. The following is the staff's evaluation of the additional exception.

> NUREG-1801 states that an ultrasonic thickness measurement of tank bottom surfaces ensures that significant degradation is not occurring. FENOC takes an exception to this element of the program, because ultrasonic (UT) measurement techniques may not be used to determine tank bottom thickness for tanks whose external bottom surfaces are not normally accessible. Pitting corrosion could potentially result in an irregular internal tank bottom surface. Meaningful results for tank bottom thickness measurements using UT require access to the unpitted surface of the tank. Access to the bottom external surface of buried fuel oil tanks and to the Unit 1 emergency diesel generator engine-mounted day tanks is impractical. For these tanks, FENOC will perform an appropriate NDE technique to determine tank wall thickness if periodic visual inspections identify significant corrosion.

The staff reviewed the additional program exception and finds that it will determine whether tank wall thickness NDE is needed based on the results of periodic visual inspections. During the audit and review, the staff interviewed the applicant's technical personnel about the frequency of the periodic visual inspections for the buried fuel oil tanks and the emergency diesel generator engine mounted day tanks. The staff noted that the frequency of the inspections is implemented by plant procedure that contains acceptance criteria for corrosion that would trigger the appropriate NDE for determining wall thickness measurements. On this basis, the staff finds this exception acceptable because it adequately explains that the appropriate NDE techniques will be implemented for the fuel oil tanks with inaccessible unpitted surfaces that are not suitable or cannot be accessed for UT measurements.

LRA AMP B.2.20 provides the following operating experience (OE) evaluation for BVPS:

> The Fuel Oil Chemistry Program is an existing program that utilizes sampling and analysis to ensure that adequate diesel fuel quality is maintained to prevent loss of material and fouling in the various in-scope fuel oil systems. Exposure of fuel oil to contaminants such as water and particulates is also minimized by periodic draining of accumulated water, tank interior cleaning, and by verifying the quality of new oil before its introduction into the storage tanks.
>
> Water has occasionally been discovered in various BVPS diesel fuel oil storage tanks during sampling activities. In accordance with sampling and analysis

procedures, any detected water is removed from the affected tank as part of the sampling process.

There have been multiple, but infrequent, instances during the past five years, where fuel oil particulate concentrations were near or above the Technical Specification limit for Emergency Diesel Generator fuel oil storage tanks. Four Corrective Action Program items were identified since 2002, which documented elevated fuel oil particulate levels in Emergency Diesel Generator fuel oil storage and day tanks. In all cases, corrective actions were taken such as recirculating the tank contents through a particulate filter. Other than these events, fuel oil sample results from 2001 through 2005 reveal that fuel oil quality is being maintained in compliance with industry standards. Regular analysis and confirmation of diesel fuel quality provide reasonable assurance that the program is effectively managing fuel oil chemistry.

A sampling schedule for diesel generator fuel oil tanks has been established, to allow timely identification of excessive concentrations of water and/or particulates, which will minimize tank loss of material. Sampling frequency is adequate as evidenced by the relatively few instances of particulate levels exceeding the Technical Specification limit. A recent CR identified elevated particulate levels which had yet to exceed the limit, but were monitored with sufficient frequency to identify a rising trend.

An important element of fuel oil (or any other) analysis is operation of the testing laboratory. Fuel oil samples from BVPS are sent to Beta Laboratory (a First Energy subsidiary) after an initial set of factors are measured at the BVPS site. The laboratory completes the oil analysis by measuring parameters such as viscosity, flash point, and percent sulfur.

A fleet oversight Quality Assurance audit was conducted to assess the operation practices and regulatory compliance of the Beta Laboratory facility. The principal tool for this assessment was the FENOC Quality Assurance Program Manual. The results of the audit reveal that Beta Lab is effective in performing analyses of the fuel oil samples from BVPS, however multiple areas for improvement were identified and Corrective Action Program items were generated to document and track the recommended improvements. The Quality Assurance audit process provides an additional level of assurance that the fuel oil chemistry program will continue to effectively monitor and manage fuel oil chemistry.

On the basis of its review and of industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concludes that the applicant's Fuel Oil Chemistry Program, would adequately manage the aging effects identified in the LRA for which this AMP is credited.

<u>UFSAR Supplement</u> In LRA Section A.1.20, the applicant provided the UFSAR Supplement for the Fuel Oil Chemistry Program. The staff reviewed this Section and determined that the information in the UFSAR Supplement provides an adequate summary description of the program consistent with that provided in the SRP-LR Table 3.1-2 for diesel fuel oil testing programs.

As a result of the staff's IP-71002 inspections that occurred during the weeks of June 23 and July 14, 2008, the applicant identified necessary revisions to the LRA which includes a new program enhancement. The applicant provided the program changes in letter L-08-262 dated, September 8, 2008 which includes LRA Amendment No. 23 which included the addition of a new enhancement to Commitment No. 10. In LRA Section A.1.20 the applicant provided the UFSAR Supplement for the new enhancement that revised the implementing procedures to perform UT thickness measurements of accessible above-ground fuel tank bottoms at the same frequency as tank cleaning and inspections to ensure degradation is not occurring.

The staff reviewed the commitment list in LRA Section A.4-1 for BVPS Unit and Table A.5-1 for BVPS Unit 2 in the UFSAR Supplemental for the application (i.e., LRA Appendix A), and confirmed that the enhancements the Fuel Oil Chemistry Program are captured in Table A4.1, Commitment No. 10 for BVPS Unit 1 and in Table A5.1, Commitment No. 11 for BVPS Unit 2.

The staff determined that the information in the UFSAR Supplement provides an adequate summary description of the program consistent with the SRP-LR because the UFSAR Supplement, as modified by LRA Amendment 23, dated September 8, 2008, is in conformance with those provided for these type of programs in Table 3.1-2 of the SRP-LR and because the enhancements of the program have been reflected in appropriate Commitments that have been placed on the UFSAR Supplement for the application.

Conclusion.The staff has reviewed the information provided in LRA Section B.2.20 and additional information provided by the applicant by letter dated July 24, 2008. On the basis of its review as discussed above, the staff finds the applicant's Fuel Oil Chemistry Program acceptable because it is consistent with the GALL Report with enhancements and exceptions, and the plant is bounded by the conditions set forth in the GALL Report for this aging management program. The staff finds that the program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program

Summary of Technical Information in the Application. In LRA Section B.2.23, the applicant described the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. This program will manage loss of material of structural components for heavy load and fuel handling components within the scope of license renewal and subject to aging management. The program focuses on inspections of structural components that make up the bridge, trolley, and rails of the cranes and hoists, and is implemented through the use of visual inspections.

Staff Evaluation. In the LRA, the applicant stated that the Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program is an existing program that is consistent with GALL AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems," with an enhancement. The enhancement includes guidance in licensee procedures to inspect for loss of material due to corrosion on certain crane components.

During the audit, the staff reviewed the applicant's onsite documentation to support its conclusion that the program elements are consistent with the elements in the GALL AMP. The staff conducted onsite interviews with the applicant's technical staff to confirm the results.

In comparing the elements in the applicant's Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, the staff found that the applicant credited its Maintenance Rule Program for meeting the GALL Report "parameters monitored/ inspected" program element by evaluating the effectiveness of the crane maintenance monitoring program and the effects of past and future usage on the structural reliability of cranes and hoists. However, the staff did not find a reference to the Maintenance Rule Program in LRBV-PED-XI.M23.

In RAI B.2.23-1, March 26, 2008, the staff requested that the applicant provide a detailed explanation on how the Maintenance Rule Program meets the GALL Report "parameters monitored/ inspected" program element recommendation.

In its response to RAI B.2.23-1, dated April 25, 2008, the applicant stated that the license renewal program evaluation document for this program has been revised to identify the site Maintenance Rule Program administrative procedure as an existing implementing procedure, and also to clearly credit the site Maintenance Rule Program administrative procedure as the implementing document for the GALL Report "parameters monitored/ inspected" program element.

Based on its review, the staff finds the applicant's response to RAI B.2.23-1 acceptable because the applicant has revised its license renewal program evaluation document for the Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program to credit the site Maintenance Rule Program administrative procedure as the implementing document for the GALL Report "parameters monitored/ inspected" program element. Therefore, the staff's concern described in RAI B.2.23-1 is resolved.

In LRA Section B.2.23, the applicant stated that an enhancement to the GALL Report "Scope of Program" and "Detection of Aging Effects" program elements includes guidance in licensee procedures to inspect for loss of material due to corrosion on certain crane components. The staff finds this enhancement acceptable because when implemented, the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will be consistent with GALL AMP XI.M23 and will add assurance of adequate management of aging effects.

The staff also reviewed the operating experience reports including a sample of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. In one report, the applicant stated that an event occurred in 2003 where programmatic deficiencies and degraded crane material conditions related to a lift of a high integrity container grapple necessitated a stop work order for radiological lifts. However, the staff determined that additional details were not readily apparent regarding the event, most notably, the resulting enhancements that were developed as a result of this event. The staff noted that a lack of response by the monitoring program would bring into question the applicant's ability to meet the GALL Report "detection of aging effects" program element.

In RAI B.2.23-2, March 26, 2008, the staff requested that the applicant provide further detail on the follow-up actions taken for this event.

In its response to RAI B.2.23-2, dated April 25, 2008, the applicant stated that the 2003 operating experience event was documented in a condition report in the FENOC Corrective Action Program, and that administrative controls were put in place to ensure that the waste handling building crane would not be used for radiological lifts until the proper corrective actions had been completed. In response, FENOC personnel completed a root cause analysis report for the event and a generic implications review, which led to another condition report being entered into the FENOC Corrective Action Program. The applicant conducted a total of 21 corrective actions to resolve the condition report, including several program enhancements.

The applicant stated that several notable corrective actions were taken as follows:

- A CAP review was required to ensure that all issues specific to an earlier, related condition report were addressed in the response to this operating experience condition report. A new corrective action was developed to track those previous issues to closure.

- The crane electrical Preventive Maintenance Procedure was revised to include inspections of the crane cameras, monitors and controllers.

- A facilitated review of the CAP condition report and the associated Root Cause Report was conducted for selected crane Operations Support and Radiation Protection Personnel to ensure they had a full understanding of the issues, potential consequences, findings and corrective actions associated with the operating experience event.

- Radwaste Personnel attended crane operator training and completed On the Job Training and Task Performance Standards to become qualified to operate the Waste Handling Building Crane.

- An Effectiveness Review (completed August 26, 2004) was performed six months after completion of the corrective actions. During the process for the implementation of the original corrective actions and during the use of the crane, additional issues were identified. These additional issues led to the development of additional condition reports and associated corrective actions. Therefore the initial Effectiveness Review was considered indeterminate, and a new corrective action was initiated to conduct another Effectiveness Review at the appropriate time following completion of the newly identified actions.

Based on its review, the staff finds the applicant’s response to RAI B.2.23-2 acceptable because the applicant has demonstrated a timely and thorough reaction to the 2003 operating experience event. Therefore, the staff’s concern described in RAI B.2.23-2 is resolved.

<u>UFSAR Supplement</u>. The applicant provided the UFSAR supplement for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program LRA

Section A.1.23. The staff reviewed this Section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The applicant committed (Commitments U1-13 and U2-14) to implement this program before the period of extended operation.

Conclusion. The staff reviewed the information provided in LRA Section B.2.23 and additional information provided by the applicant by letter dated April 25, 2008. Based on its review, the staff concludes that the applicant has demonstrated that effects of aging on crane and trolley structural components for those cranes that are within the scope of 10 CFR 54.4, and the effects of wear on the rails in the rail system will be adequately managed so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds 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 Program

Summary of Technical Information in the Application. In LRA Section B.2.25, the applicant described the existing Masonry Wall Program as consistent, with an enhancement, with GALL AMP XI.S5, "Masonry Wall Program." This program will manage aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operation.

The program includes all masonry walls identified as performing intended functions pursuant to 10 CFR 54.4. Components included in this program are the masonry walls pursuant to 10 CFR 50.48, radiation shielding masonry walls, and masonry walls with the potential to affect safety-related components. The Masonry Wall Program is implemented as part of the Structures Monitoring Program. Masonry walls are visually examined at a frequency selected to ensure no loss of intended function between inspections.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancement to determine whether the AMP, with the enhancement, is adequate to manage the aging effects for which the LRA credits it. The staff interviewed the applicant's technical staff and reviewed the associated bases documents for the Masonry Wall Program, which assesses the AMP elements' consistency with GALL AMP XI.S5.

The staff noted that the Masonry Wall Program is part of the Structures Monitoring Program that implements structures monitoring requirements pursuant to 10 CFR 50.65. The program manages aging of masonry walls and their structural steel restraint systems within the scope of license renewal and is guided by NRC IE Bulletin 80-11, "Masonry Wall Design," and NRC IN 87-67, "Lessons Learned from Regional Inspections of Licensee Actions in Response to NRC IE Bulletin 80-11." Components included in this program are the masonry walls pursuant to 10 CFR 50.48, radiation shielding masonry walls, and masonry walls with the potential to affect safety-related components. The Masonry Wall Program describes inspection guidelines, lists causes of aging of masonry walls to be monitored during structural monitoring inspections, and establishes examination criteria, evaluation requirements, and acceptance criteria.

During the audit and review, the staff requested that the applicant verify the frequency of visual examination for the program and its technical basis. In its response, the applicant stated that the inspection is implemented by the Structures Monitoring Program and consists of visual inspection for cracking in joints, deterioration of penetrations, missing or broken blocks, missing mortar, and general mechanical soundness of steel supports. Visual inspections are at least every five years to ensure no loss of intended function between inspections.

The staff reviewed the Masonry Wall Program by comparing the 10 elements in the applicant's program for which the applicant claims consistency with GALL AMP XI.S5. The staff finds the program acceptable, because it conforms to the recommended GALL AMP XI.S5, with enhancements as described below.

<u>Enhancement 1</u>. In the LRA, the applicant credited an enhancement to the GALL Report program element "scope of the program." Specifically, the enhancement states:

> The scope of the existing program is comprised of masonry walls within the scope of 10 CFR 50.65 (The Maintenance Rule). The scope of the program will be enhanced to include additional masonry walls identified as having aging effects requiring management for license renewal.

The staff reviewed the plant procedures and the aging effects requiring management under the scope of the Masonry Wall Program. The staff finds this information acceptable because the corrective action program will consider expanding the scope if significant degradation is observed.

The staff finds this enhancement acceptable because, when the enhancement is implemented, the Masonry Wall Program will be consistent with GALL AMP XI.S5 and provide additional assurance that the effects of aging will be adequately managed.

<u>Enhancement 2</u>. In a letter dated September 8, 2008, the applicant added to LRA Commitment No. 14 and credited an enhancement to the GALL Report program element "monitoring and trending." Specifically, the enhancement states:

> The results of the Masonry Wall Program inspections are incorporated into the inspection report to document the condition of the walls.

The staff reviewed the applicant's additional commitment and the aging effects requiring management under the monitoring and trending of the Masonry Wall Program. The staff finds this information acceptable since the corrective action program will consider expanding the inspection scope, if significant degradation is observed.

The staff finds this enhancement acceptable because, when the enhancement is implemented, the Masonry Wall Program will be consistent with the GALL Report and provides additional assurance that the effects of aging will be adequately managed.

The staff reviewed those portions of the Masonry Wall Program for which the applicant claims consistency with GALL AMP XI.S5 and finds that they are consistent with the GALL AMP. The staff finds the applicant's Masonry Wall Program acceptable because it conforms to the recommended AMP, with the enhancements described.

Operating Experience. The staff reviewed the operating experience provided in the LRA, and Operation Experience Review Report (Masonry Wall's section), and interviewed the applicant's technical staff to confirm that the plant-specific operating experience has been reviewed by the applicant and is evaluated in the GALL Report. During its audit, the staff requested that the applicant's technical staff explain why the results of the inspection in June 2000 were sent to design engineering for evaluation. The applicant stated that the design engineering organization reviews any conditions found. The staff reviewed those result conditions and found they were minor in nature and did not affect the structural integrity of any of the structures reviewed. Furthermore, the staff confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report. The staff finds that the applicant's Masonry Wall Program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and correcting the aging effects of masonry walls and confirms that the plant-specific operating experience revealed no degradation not bounded by industry experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

UFSAR Supplement. The applicant provided the UFSAR supplement for the Masonry Wall Program in LRA Section A.1.25. The staff reviewed this Section and finds the UFSAR supplement information an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. Based on its audit and review of the applicant's Masonry Wall Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirms that their implementation prior to the period of extended operation will make the existing Masonry Wall Program consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 Reactor Head Closure Studs Program

Summary of Technical Information in the Application. In LRA Section B.2.34, the applicant described the Reactor Head Closure Studs Program. This program will manage the effects of aging of the reactor head closure studs, nuts, washers and RV flange threads. Examinations for the program are conducted during each ISI interval as part of the Inservice Inspection Program. The examinations are performed in accordance with the ASME Code Section XI requirements. The applicant will use the ASME Code edition consistent with the provisions of 10 CFR 50.55a, during the period of extended operation.

Staff Evaluation. In the LRA, the applicant stated that the Reactor Head Closure Studs Program is an existing program that is consistent with GALL AMP XI.M3, "Reactor Head Closure Studs," with an exception. The exception is to the ASME Code Section XI edition, in which the GALL Report AMP specifies the use of ASME Code Section XI, 2001 Edition, including the 2002 and 2003 Addenda, whereas the applicant currently uses the ASME Code Section XI, 1989 Edition.

During its audit, the staff reviewed the applicant's onsite documentation to support its conclusion that the program elements are consistent with the elements in GALL AMP XI.M3.

The staff compared the elements in the applicant's program with the GALL Report program elements. In comparing the 10 elements in the applicant's program, the staff found that the applicant has addressed all 10 elements in a satisfactory manner. In addition, the 10 elements were consistent with GALL AMP XI.M3.

The applicant has taken an exception to the ASME Code Section XI code edition in that the applicant identified that the current ASME Code Section XI edition on record for Units 1 and 2 is ASME Code Section XI, 1989 Edition, with no addenda. The applicant credits this edition of the code for aging management. The staff noted that this was the ASME Code Section XI edition in effect for the 3rd 10-Year ISI Interval for Unit 1 and the 2nd 10-Year ISI Interval for Unit 2. The staff noted that the applicant indicated that Unit 1 entered its 4th 10-Year ISI Interval on April 1, 2008 and that Unit 2 is scheduled to enter its 3rd 10-Year ISI Interval on August 29, 2008. Pursuant to 10 CFR 50.55a, the applicant was required to implement the ASME Code Section XI, 2001 Edition, including the 2002 and 2003 Addenda, upon entrance into the 4th 10-Year ISI Interval for Unit 1, and will be required to implement this same edition, including addenda, upon entrance into the 3rd 10-Year ISI Interval for Unit 2.

In RAI B.2-2, dated June 5, 2008, the staff requested that the applicant clarify the ASME Code Section XI edition credited for those AMPs that credit applicable ASME Code Section XI requirement criteria for aging management.

In its response to RAI B.2-2, dated July 21, 2008, the applicant stated that the 4th (Unit 1) and 3rd (Unit 2) 10-Year ISI Intervals will use ASME Code Section XI, 2001 Edition, including the 2002 and 2003 Addenda. These intervals are scheduled to begin on April 1, 2008 (4th- Unit 1) and August 29, 2008 (3rd – Unit 2). The staff concludes that this edition of the ASME Code Section XI is consistent with the recommended edition in the GALL Report.

Based on its review, the staff finds the applicant's response to RAI B.2-2 acceptable because the applicant has clarified that it will credit the ASME Code Section XI, 2001 Edition, including the 2002 and 2003 addenda, for aging management. Therefore, the staff's concern described in RAI B.2-2 is resolved.

The staff also reviewed the operating experience reports to confirm that the plant-specific operating experience and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The reports indicated that in 2006, RFOs 1R17 and 2R12 included reactor head studs UT examinations which both resulted in no undesirable indications. The reports further indicated that there is no history of RV studs, nuts, and washers with cracks or anything more significant than "minor nicks and scratches".

UFSAR Supplement. The applicant provided the UFSAR supplement for the Reactor Head Closure Studs Program in LRA Section A.1.34. The staff reviewed this Section and determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. The staff reviewed the information provided by the applicant in LRA Section B.2.34. Based on its review, the staff concludes that the applicant has demonstrated that effects of aging on reactor head closure studs and nuts constructed from materials with a maximum tensile strength limited to less than 170 ksi, will be adequately managed so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.2.12 Structures Monitoring Program

Summary of Technical Information in the Application. In LRA Section B.2.39, the applicant described the Structures Monitoring Program. This program implements the requirements of 10 CFR 50.65 (the Maintenance Rule). The applicant stated that this program follows the guidance provided in RG 1.160 and NUMARC 93-01. These two documents provide guidance for development of licensee-specific programs to monitor the condition of structures and structural components within the scope of the Maintenance Rule, to ensure no loss of structure or structural component intended function.

Staff Evaluation. In the LRA, the applicant stated that its Structures Monitoring Program is an existing plant program that is consistent with GALL AMP XI.S6, “Structures Monitoring Program,” with enhancements.

The staff reviewed the applicant’s onsite documentation to determine whether the program elements are consistent with the elements in the GALL Report program. The staff also reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited. The staff interviewed the applicant’s technical staff and reviewed the documents related to the Structures Monitoring Program, including the license renewal program evaluation report in which the applicant assessed whether the program elements are consistent with GALL AMP XI.S6.

The staff noted that the Structures Monitoring Program manages cracking, loss of material, and change in material properties by monitoring the condition of structures and structural supports within the scope of license renewal. The program provides inspection guidelines and walkdown checklists for concrete elements, structural steel, masonry walls, structural features (*e.g.*, caulking, sealants, roofs, etc.), structural supports, and miscellaneous components like doors. The program includes all masonry walls within the scope of license renewal and inspects supports for equipment; piping; conduit; cable tray; heating, ventilation, and air conditioning (HVAC); and instrument components. Although coatings may be applied to the external surfaces of structural members, no credit was taken for these coatings when determining the effects of aging on underlying materials. The staff noted that failure of coatings could result in aging effects for the steel shell in containment. The failure of coatings could also result in the failure of safety systems to perform their intended functions.

In RAI B.2.39-1, dated April 30, 2008, the staff requested that the applicant justify not having an AMP for coatings.

In its response to RAI B.2.39-1, dated June 6, 2008, the applicant stated:

> The potential for containment sump blockage due to debris is an event-driven concern that is addressed by the plants' current licensing basis. Aging of coatings does not affect the assumptions used in the evaluation of potential sump blockage. Coatings do not perform or support any of the intended functions listed in 10 CFR 54.4. Therefore, management of aging for containment coatings as a separate subcomponent is not required for compliance with 10 CFR 54.4, and a program corresponding to NUREG-1801 XI.S8, Protective Coating Monitoring and Maintenance Program, is not credited in the BVPS LRA.

Based on its review, the staff finds the applicant's response to RAI B.2.39-1 acceptable because the applicant has adequately justified its basis for not having an AMP for coatings. The staff reviewed the applicant's responses and concludes that since there are no GALL line items that specify use of a coatings AMP, there is no need for this program. The staff determines that the aging of coatings in containment will be managed using the ASME Code Section XI, Subsection IWE Program. Therefore, the staff's concern described in RAI B.2.39-1 is resolved.

The staff finds the applicant's responses and its Structures Monitoring Program acceptable because it conforms to the recommended GALL AMP XI.S6, with enhancements as described below.

Enhancement 1. For license renewal, the scope will be enhanced to include additional structures and structure components which were identified in the license renewal aging management review report.

The staff reviewed the applicant's Structures Monitoring Program and its AERM, under the "scope of the program" element of the Structures Monitoring Program. The staff finds that by including as in-scope the main intake structure, roofs, and manholes for degradation of concrete, steel, conduit, trays, and supports, the enhancement is acceptable because when implemented, the applicant's Structures Monitoring Program will be consistent with GALL AMP XI.S6. This enhancement provides additional assurance that the effects of aging will be adequately managed.

Enhancement 2. In the LRA, the applicant credits an enhancement to the GALL Report program element "parameters monitored / inspected." Specifically, the enhancement states that the applicant will "provide inspection guidance in program implementing procedures to detect significant cracking in concrete surrounding the anchors of vibrating equipment."

The staff reviewed the applicant's Structures Monitoring Program, and the AERM under the "parameters monitored/inspected" element of the Structures Monitoring Program. The staff found this element is not clear in how the applicant satisfies the GALL Report recommendations. Specifically, the GALL Report program element suggests American Concrete Institute (ACI) 349.3R-96 and ANSI/American Society of Civil Engineers (ASCE) 11-90 as an acceptable basis for the selection of parameters to be monitored or inspected, but the LRA does not mention these standards.

In RAI B.2.39-4, dated April 30, 2008, the staff requested that the applicant explain how large must a crack be for consideration as "significant" and which industry codes, standards, and guidelines form the basis for this program element.

In its response to RAI B.2.39-4, dated June 6, 2008, the applicant stated:

> The BVPS Structures Monitoring Program does not directly cite ACI 349.3R-96 or ANSI/ASCE 11-90 as the basis for selection of parameters to be monitored. The structural parameters monitored under the current BVPS Maintenance Rule structural inspection program were identified in 1996 using the guidance existing at that time; primarily NEI 96-03, Revision D, and Westinghouse Owner's Group, "Life cycle management Aging Assessment Field Guide." The fundamental attributes of structural deficiency types and documentation are consistent between the BVPS Structures Monitoring Program and ACI 349.3R-96, which NEI 96-03 references.

Based on its review, the staff finds the applicant's response to RAI B.2.39-4 acceptable because the applicant has adequately justified that since the structural parameters monitored were identified in1996 using the guidance existing at that time, there is no need to refer back to ACI 349.3R-96 or ANSI/ASCE 11-90. Therefore, the staff's concern described in RAI B.2.39-4 is resolved.

The staff finds the applicant responses and the enhancement acceptable, because when the enhancement is implemented, the applicant's Structures Monitoring Program will be consistent with GALL AMP XI.S6 and will provide additional assurance that the effects of aging will be adequately managed.

<u>Enhancement 3</u>. In the LRA, the applicant credits an enhancement to the GALL Report program element "parameters monitored / inspected." Specifically, the enhancement states the applicant will "perform opportunistic inspections of normally inaccessible below-grade concrete when excavation work uncovers a significant depth."

The staff reviewed the applicant's Structures Monitoring Program and the AERM, under the "parameters monitored/inspected" element of the Structures Monitoring Program. The staff finds this enhancement acceptable to perform opportunistic inspections of normally inaccessible below-grade concrete structures when excavation occurs. The staff concludes that more frequent inspections may be based on past inspection results, industry experience, or exposure to a significant event (*i.e.*, tornado, earthquake, fire, or chemical spill). On this basis, the staff finds this enhancement acceptable because when implemented the Structures Monitoring Program will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

<u>Enhancement 4</u>. In the LRA, the applicant credits an enhancement to the GALL Report program element "parameters monitored/inspected." Specifically, the enhancement states the applicant will "perform periodic sampling of groundwater for pH, chloride concentration, and sulfate concentration."

The staff reviewed the applicant's Structures Monitoring Program, and the AERM under the "parameters monitored / inspected" element of the Structures Monitoring Program. The staff found it is not clear how the applicant satisfies the GALL Report recommendations for this element, because the applicant does not include the frequency of periodic sampling of ground water for pH, chloride, and sulfate concentration.

In RAI B.2.39-2, dated April 30, 2008, the staff requested that the applicant provide the time frame for the "periodic" sampling, and the results for the last two samplings of groundwater.

In its response to RAI B.2.39-2, dated June 6, 2008, the applicant indicated that the license renewal future commitment item number 20 in the LRA table A.4-1 (Unit 1), and future commitment item 22 in the LRA table A.5-1 (Unit 2), are revised to state that the implementation schedule for groundwater monitoring will begin five years prior to entering the period of extended operation in 2016 for Unit 1 and in 2027 for Unit 2, then continue on a 5- year interval thereafter. The applicant also provided the groundwater results for 2003 and 2007 as follows: pH 6.87 and 6.83; chlorides 44.6 ppm and 208 ppm; sulfates 1.2 ppm and 187 ppm, respectively.

Based on its review, the staff finds the applicant's response to RAI B.2.39-2 acceptable because the applicant has provided the time frame for the "periodic" sampling, and the results for the last two samplings of groundwater. The staff reviewed the applicant's responses and confirms that the applicant's 5-year interval for monitoring the BVPS groundwater for non-aggressive water chemistry is in accordance with the industry's standards and the results for pH were greater than 5.5; chlorides less than 500 ppm; and sulfates were less than 1500 ppm. Therefore, the staff's concern described in RAI B.2.39-2 is resolved.

The staff notes that when the enhancement is implemented, the applicant's Structures Monitoring Program will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

<u>Enhancement 5</u>. In the LRA, the applicant credits an enhancement to the GALL Report program element "parameters monitored/inspected." Specifically, the enhancement states that the applicant will "monitor elastomeric materials used in seals and sealants, including compressible joints and seals, waterproofing membranes, etc., associated with in-scope structures and structural components for cracking and change in material properties."

The staff reviewed the applicant's Structures Monitoring Program, and the AERM under the "parameters monitored/inspected" element of the Structures Monitoring Program. The staff found this enhancement is to ensure that aging degradation leading to loss of intended functions will be detected and the extent of degradation can be determined. The staff finds this enhancement acceptable because when it is implemented, the applicant's Structures Monitoring Program will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

In a letter dated September 8, 2008, the applicant added to LRA Commitment No. 22, to include new program enhancements under program elements "detection of aging effects," "monitoring and trending," and "acceptance criteria," as described below.

<u>Enhancement 6</u>. In LRA Commitment No. 22, the applicant credits an enhancement to the GALL Report program element "detection of aging effects." Specifically, the enhancement states that the applicant will "perform specific measurements and/or characterizations of structural

deficiencies based on the results of previous inspections and guidance from ACI 349.3R-96, Section 5.1.1, and ACI 201.1-68."

The staff reviewed the applicant's Structures Monitoring Program, and the AERM under the "detection of aging effects" element of the Structures Monitoring Program. The staff found this enhancement acceptable because when the enhancement is implemented, the applicant's Structures Monitoring Program will be consistent with GALL AMP XI.S6 and will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 7. In LRA Commitment No. 22, the applicant credits an enhancement to the GALL Report program element "monitoring and trending." Specifically, the enhancement states that the applicant will "document in the program inspection report a comparison of the results of the program inspections with the results of the previous program inspection, and to file the Structures Monitoring Program inspection reports in the BVPS document control system so that inspection results can be more effectively monitored."

The staff reviewed the applicant's Structures Monitoring Program, and the AERM under the "monitoring and trending" element of the Structures Monitoring Program. The staff found this enhancement acceptable because when the enhancement is implemented, the applicant's Structures Monitoring Program will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 8. In LRA Commitment No. 22, the applicant credits an enhancement to the GALL Report program element "acceptance criteria." Specifically, the enhancement states that the applicant will "apply inspection acceptance criteria based on the results of past inspections and guidance from ACI 349.3R-96, Section 5.1.1, and ACI 201.1-68, and the deficiencies will be reported using the corrective action program."

The staff reviewed the applicant's Structures Monitoring Program, and their AERM under the "acceptance criteria" element of the Structures Monitoring Program. The staff found this enhancement acceptable because when the enhancement is implemented, the applicant's Structures Monitoring Program will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

Operating Experience. The staff also reviewed the operating experience provided in the LRA and Operation Experience Review Report, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience has been reviewed by the applicant and is evaluated in the GALL Report. During its audit, the staff noted that the applicant does not include the 2006 inspection results.

In RAI B.2.39-3, dated April 30, 2008, the staff requested that the applicant provide 2006 inspection results versus the 1996 baseline inspection and 2001 inspection results versus 2006 inspection results. The staff also requested that the applicant provide the location, size, and depth of the reappearing corroded steel found in the 2001 inspection, which was painted as a result of the 1996 baseline inspection.

In its response to RAI B.2.39-3, dated June 6, 2008, the applicant stated that the 2006 inspection report concluded, overall, that plant structures were in good condition and performing well. The inspection found no conditions requiring immediate maintenance or repair. Minor conditions were noted and did not affect the structural integrity of any of the structures reviewed. Many of the observed conditions were noted for further review during the next inspection schedule. Conditions noted in the 2001 and 1996 inspections and later revisited revealed that, in most cases, little or no change had occurred from the previous observations. The applicant also stated that since little change was evident from the 1996 and 2001 inspections, and the conditions identified were considered minor in nature, the scheduled programmatic maintenance rule inspections provide reasonable assurance that the effects of aging will be managed to ensure that the structural integrity of plant systems, structures, and components will be maintained during the period of extended operation.

Based on its review, the staff finds that applicant’s response to RAI B.2.39-3 acceptable because the applicant verified that its Structures Monitoring (maintenance rule) Program is consistent with GALL Report and provides additional assurance that the effects of aging will be adequately managed. Furthermore, the staff confirmed that the applicant has addressed operating experience identified after the issuance of the GALL Report. The staff also finds that the applicant’s Structures Monitoring Program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and correcting the effects of structures monitoring and can be expected to ensure that existing program operating experience revealed no degradation not bounded by industry experience. Therefore, the staff’s concern described in RAI B.2.39-3 is resolved.

Based on its review of the operating experience and discussions with the applicant’s technical staff, the staff concludes that the applicant’s Structures Monitoring Program will adequately manage the aging effects that are identified in the LRA for BVPS for which this AMP is credited.

The staff confirmed that the “operating experience” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. The applicant provided the UFSAR supplement for the Structures Monitoring Program in LRA Section A.1.39. The staff reviewed this Section and finds the UFSAR supplement information an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. Based on its audit and review of the applicant’s Structures Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirms that their implementation prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.13 Water Chemistry Program

Summary of Technical Information in the Application. In LRA Section B.2.42, the applicant described the existing Water Chemistry Program as consistent, with enhancement, with GALL AMP XI.M2, "Water Chemistry."

The Primary and Secondary Water Chemistry Program mitigates damage caused by corrosion and SCC. The Water Chemistry Program monitors and controls water chemistry based on EPRI TR-105714, Revision 5 (TR-1002884), "PWR Primary Water Chemistry Guidelines," and EPRI TR-102134, Revision 6 (TR-1008224), "PWR Secondary Water Chemistry Guidelines."

The One-Time Inspection Program will verify the effectiveness of the Water Chemistry Program for circumstances described in the GALL Report that require augmentation of the program.

Staff Evaluation. In LRA Section B.2.42, the applicant stated that the Water Chemistry Program is an existing program that is consistent with GALL Report AMP XI.M2, "Water Chemistry," with enhancement.

The staff reviewed those portions of the applicant's Water Chemistry Program that the applicant claimed consistency with GALL AMP XI.M2 and found they are consistent with this GALL AMP. The staff also confirmed that the plant program contains all of the elements of the referenced GALL program and the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant's technical staff to confirm these results.
The staff finds the applicant's Water Chemistry Program, as confirmed by the One-Time Inspection Program acceptable because it conforms to the recommended GALL AMP XI.M2. The staff's review of the enhancement of the AMP that are taken against the program elements in GALL AMP XI.M2 are evaluated in the subsections that follow.

Enhancements. In comparing the elements in the applicant's Water Chemistry Program, the staff found that the applicant has taken enhancements as follows:

> Change monitoring frequency for reactor coolant silica in "Monitoring and Trending." The silica monitoring will be increased to once per week during Modes 1 and 2, and once per day during heatup in Modes 3 and 4.

The staff reviewed the enhancement and compared the changes with the GALL AMP XI.M2 recommendations for the enhanced element. The staff also reviewed the basis documents referenced in the enhancements. The staff determined that implementation of this enhancement will make the applicant's Water Chemistry Program consistent with the GALL AMP XI.M2. The applicant adopted more restrictive requirements for sampling silica than those recommended in the GALL Report. On this basis, the staff finds the enhancement acceptable.

Operating Experience. In LRA Section B.2.42, the applicant provided the following operating experience evaluation for BVPS:

> The BVPS Water Chemistry Program is based on EPRI primary and secondary water chemistry guidelines, and as such, is sensitive to industry operating

experience. Operating experience events are evaluated for potential inclusion in subsequent revisions of the EPRI guidelines based on significance and frequency of occurrence. The implementation of the EPRI guidelines at BVPS is monitored using the Corrective Action Program and is validated using Nuclear Quality Assurance audits. During the interim between revisions to the EPRI documents, operating experience from INPO is evaluated for applicability to BVPS.

BVPS Unit 1 RCS zinc concentration was occasionally out of specification between September of 2004 and November of 2006. Industry operating experience demonstrated that cracking in alloy-600 is minimized if zinc concentration is maintained at an optimum value. Evidence at BVPS Unit 1 supports this assertion. The number of PWSCC indications during the Unit 1 Cycle 16 Refueling Outage (October - November 2004) (following zinc injection) decreased from a predicted number of 25, to 5 actual indications.

Between July 2000 and September 2006, secondary chemistry parameters at both BVPS units were occasionally out-of-spec for sulfate, sodium, dissolved oxygen, pH, and chloride concentration, resulting in potential chemistry action level 1 conditions. The Corrective Action Program was used to document and investigate the reason(s) for these out-of-spec conditions and to recommend corrective actions to restore the affected parameter(s) to an acceptable value before a plant shutdown is required.

In December, 2002, BVPS demonstrated its responsiveness to industry operating experience by applying a significant lesson learned from a human-performance chemistry addition error which occurred several days earlier at another plant. At BVPS, a chemistry technician independently performed a self-check and determined that he was obtaining the wrong chemical for addition to the feedwater system. He was motivated to perform this self-check as a result of a recent review of an INPO operating experience document which described a similar error at another plant in which the incorrectly obtained chemical was actually added to the secondary system resulting in an unplanned plant shutdown. The technician's application of pertinent operating experience prevented this near miss from becoming a significant plant event.

A Quality Assurance audit of the primary and secondary plant chemistry program was conducted in 2006. This audit revealed that monitoring and action requirements for Primary and Secondary water chemistry complied with BVPS Technical Specifications, implementing procedures, and the Licensing Requirements Manual (LRM). The BVPS chemistry sampling guidelines and limits were consistent with industry guidelines endorsed by EPRI, and were designed to extend the operating life of primary and secondary systems and components. An example of the BVPS adherence to chemistry control is evident from the primary chemistry performance indicator (percent of time that RCS hydrogen, lithium, & zinc concentrations were within spec), which for Unit 1 and Unit 2 (no zinc) during 2005, were 97% and 99.8%, respectively.

> Conformance to procedural requirements and industry guidelines, and sensitivity to operating experience reports provide reasonable assurance that the Water Chemistry program will effectively manage loss of material, cracking, and reduction of heat transfer for in-scope components during the period of extended operation.

The staff noted that the applicant's operating experience discussion demonstrates that the applicant has been effective in maintaining acceptable primary and secondary water quality at Units 1 and 2, consistent with the applicable EPRI guidelines for primary and secondary water chemistry control and implements appropriate corrective actions, self assessments and quality assurance audits of the program. Based on its review and of industry and plant-specific operating experience and discussions with the applicant's technical personnel, the staff concludes that the applicant's Water Chemistry Program, will adequately manage the aging effects identified in the LRA for which this AMP is credited because: (a) the applicant is implementing its program in accordance with appropriate EPRI guidelines on primary and secondary water chemistry controls, (b) operating experience over the last five years has demonstrated excellent conformance to the EPRI primary and secondary water chemistry guidelines, (c) the applicant appropriately takes prompt corrective actions when the water chemistry parameters for the primary or secondary coolants are out of specification with the EPRI water chemistry guidelines, and (d) the program includes periodic self assessments and QA that are used to adjust and improve the programs based on past performance.

<u>UFSAR Supplement. T</u>he applicant provided the UFSAR supplement for the Water Chemistry Program in LRA Section A.1.42. The staff reviewed this Section and determines that the information in the UFSAR supplement provides an adequate summary description of the program, consistent with that provided in SRP-LR Table 3.1-2.

The staff reviewed the applicant's commitment list in LRA Section A.4-1 for BVPS Unit 1 and Table A.5-1 for BVPS Unit 2 in the UFSAR supplement and confirms that the enhancement to the Water Chemistry Program is reflected in UFSAR Table A.4-1 for Unit 1 (Commitment No.23) and in UFSAR Table A.5-1 for Unit 2 (Commitment No. 25).

The staff determines that the information in the UFSAR supplement provides an adequate summary description of the program consistent with the SRP-LR because the UFSAR supplement conforms to the guidance in SRP-LR Table 3.1-2 and because the enhancement to the program has been reflected in appropriate commitments in the UFSAR supplement.

<u>Conclusion.</u> The staff reviewed the information provided by the applicant in LRA Section B.2.42. Based on its review, the staff finds the applicant's Water Chemistry Program acceptable because it is consistent with the GALL Report, with enhancements, and the plant is bounded by the conditions set forth in the GALL Report for this AMP. The staff finds that the program will adequately manage the aging effects so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP finds 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:

- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program
- Electrical Wooden Poles/Structures Inspection Program (Unit 2)
- Reactor Vessel Integrity Program
- Settlement Monitoring Program (Unit 2)
- Selective Leaching of Materials Program

For AMPs not consistent with or not addressed in the GALL Report the staff's complete review determined their adequacy to monitor or manage aging. The staff's review of these plant-specific AMPs is documented in the following sections.

3.0.3.3.1 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program

Summary of Technical Information in the Application. In LRA Section B.2.10, the applicant described the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program as a new plant-specific AMP developed as an alternative to GALL AMP XI.E6, "Electrical Cable Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements." This program will be implemented prior to the period of extended operation.

Staff Evaluation. The staff reviewed the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program against the AMP elements found in SRP-LR Section A.1.2.3, and in SRP-LR Table A.1-1, focusing on how the program manages aging effects through the effective incorporation of 10 elements (*i.e.*, "Scope of the Program," "Preventive Actions," "Parameters Monitored or Inspected," "Detection of Aging Effects," "Monitoring and Trending," "Acceptance Criteria," "Corrective Actions," "Confirmation Process," "Administrative Controls," and "Operating Experience").

The program elements (7) "Corrective Actions," (8) "Confirmation Process," and (9) "Administrative Controls" are parts of the site-controlled QA program. The staff's evaluation of elements 7, 8, and 9 can be found in SER Section 3.0.4. Evaluation of the remaining seven elements follows:

Scope of Program. The "Scope of Program" program element criterion in SRP-LR Section Appendix A.1.2.3.1 states that the program scope should include specific structures and components addressed by this program.

The applicant stated in the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program, for the "Scope of Program" program element, that this program applies to Non-EQ connections associated with cables within the scope of license renewal. This program does not include the high-voltage (>35 kV) switchyard connections. In-scope connections are evaluated for applicability of this program. The criteria for including connections in the program are that the connection is a bolted connection and is not covered under the EQ program or an existing preventive maintenance program.

The staff determined that the specific commodity groups for which the program manages aging effects are identified (Non-EQ bolted cable connections associated with cables within the scope of license renewal), which satisfies the criterion defined in SRP-LR Section A.1.10. The staff also determined that the exclusion of high-voltage (>35 kV) switchyard connections, connections covered under EQ program and an existing preventive maintenance program, is acceptable. Switchyard connections are addressed in SER Section 3.6.2.2.3. EQ cable connections are covered in accordance with 10 CFR 50.49. Cable connections under preventive maintenance program are periodically inspected. On this basis, the staff finds that the applicant's scope of program acceptable.

Preventive Actions. The "preventive actions" program element criterion in SRP-LR Section A.1.2.3.2 states that the activities for prevention and mitigation programs should be described. These actions should mitigate or prevent aging degradation and for condition or performance monitoring programs, they do not rely on preventive actions and thus, this information need not be provided. More than one type of AMP may be implemented to ensure that aging effects are managed.

The applicant states in the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program for the "preventive actions" program element that this one-time inspection program is a condition monitoring program; therefore, no actions are taken as part of this program to prevent or mitigate aging degradation.

The staff determined that the preventive actions program element satisfies the criterion defined in SRP-LR Section B.1.2.3.2. The staff finds this program element acceptable because it is a condition monitoring program and there is no need for preventive actions. On this basis, the staff finds the applicant's preventive actions acceptable.

Parameter Monitored/Inspected. The "parameter monitored or inspected" program element criteria in SRP-LR Section A.1.2.3.3 states that the parameter to be monitored or inspected should be identified and linked to the degradation of the particular structure and component intended function(s). The parameter monitored or inspected should detect the presence and extent of aging effects.

The applicant states in the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program for the "parameters monitored/inspected" program element that this program will focus on the metallic parts of the cable connections. The one-time inspection verifies that loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation is not an issue that requires a periodic AMP.

The staff determined that the "parameters monitored/inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. Loosening (or high resistance) of bolted cable connections are potential aging effects due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. The design of bolted cable connections usually account for the above stressors. The one-time inspection is to confirm that these stressors are not an issue that requires a periodic AMP. On this basis, the staff finds that the applicant's parameters monitored or inspected acceptable.

Detection of Aging Effects. The "detection of aging effects" program element criteria in SRP-LR Section A.1.2.3.4 states that information should be provided that links the parameters to be monitored or inspected to the aging effects being managed; describe when, where, and how program data are collected (*i.e.*, all aspects of activities to collect data as part of the program); link the method for the inspection population and sample size when sampling is used to inspect a group of structures and components (SCs) and the inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects.

The applicant states in the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program, the "detection of aging effects" program element, that a representative sample of electrical connections within the scope of license renewal, and subject to an AMR will be inspected or tested prior to the period of extended operation, to verify that there are no aging effects requiring management during the period of extended operation. The factors considered for sample selection will be application (medium and low voltage), circuit loading (high load), and location (high temperature, high humidity, vibration, etc.). The technical basis for the sample selected is to be documented. Inspection methods may include thermography, contact resistance testing, or other appropriate methods, including visual, based on plant configuration and industry guidance. The one-time inspection provides additional confirmation to support operating experience that shows electrical connections have not experienced a high degree of failures, and that existing installation and maintenance practices are effective.

GALL AMP XI.E6 states that testing may include thermography, contact resistance testing, and other appropriate testing methods. In the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program, the applicant states that inspection methods may include thermography, contact resistance testing, or other appropriate methods including visual inspection based on plant configuration and industry guidance. The staff determined that a one-time visual inspection may not be adequate to detect heat or high resistance of loose cable connections.

In RAI B.2.10-1, dated May 15, 2008, the staff requested that the applicant provide a technical justification of how visual inspection, if used alone, will be sufficient to detect loss of preload or loosening of bolted connections.

In its response to RAI B.2.10-1, dated June 17, 2008, the applicant stated the BVPS program described in LRA Section B.2.10 is revised to delete "visual inspection" as an alternative to thermography or contact resistance testing, because detection of aging effects for electrical cable connection is difficult using visual inspection techniques. The applicant further stated that LRA Section B.2.10 is revised to read:

> Detection of Aging Effects
>
> A representative sample of electrical connections with the scope of license renewal, and subject to AMR review will be inspected or tested prior to the period of extended operation to verity there are no aging effects requiring management

> during the period of extended operation. The factors to be considered for sample selection will be application (medium and low voltage), circuit loading (high load), and location (high temperature, high humidity, vibration, etc.). The technical basis for the sample selected is to be documented. Inspection methods will include quantitative measurements such as thermography, contact resistance testing, or other appropriate methods based on plant configuration and industry guidance. The one-time inspection provides additional confirmation to support industry operating experience that shows electrical connections have not experienced a high degree of failures, and that existing installation and maintenance practices are effective.

Based on its review, the staff finds the applicant's response to RAI B.2.10-1 acceptable because that applicant has verified that resistance measurement or thermography is a preferred method for testing loose cable connections and these test methods are consistent with those in the GALL AMP XI.E6. The staff confirms that the applicant has revised the LRA to reflect this change. Therefore, the staff's concern described in RAI B.2.10-1 is resolved.

On this basis, the staff finds that the applicant's description of parameters monitored or inspected acceptable.

Monitoring and Trending. The "monitoring and trending" program element criteria in SRP-LR Section A.1.2.3.5 states that monitoring and trending activities should be described and provide predictability of the extent of degradation and thus effect timely corrective or mitigative actions. This program element describes how the data collected are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

The applicant stated in the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program for the "monitoring and trending" program element, that in this program, trending actions are not included because this is a one-time inspection. The staff determined that absence of trending for testing is acceptable, since the test is a one-time inspection and the ability to trend inspection results is limited by the available data.
Furthermore, the staff determined no need for such activities. On this basis, the staff finds the applicant's monitoring and trending acceptable.

Acceptance Criteria. The "acceptance criteria" program element criteria found in SRP-LR Section A.1.2.3.6 states that the acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions, during the period of extended operation. The program should include a methodology for analyzing the results against applicable acceptance criteria. Qualitative inspections should be performed to the same predetermined criteria as quantitative inspections in compliance with ASME Code and through approved site-specific programs.

The applicant stated in the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program for the "acceptance criteria" program element, that the acceptance criteria for each inspection and/or surveillance is defined by the specific type of inspection or test performed for the specific type of cable connections. Acceptance criteria ensure that the intended functions of the cable connections can be maintained consistent with the CLB.

The staff determined that this program element satisfies the criteria defined in SRP-LR Section A.1.2.3.6. The staff finds exception acceptable on the basis that acceptance criteria for inspection and/or surveillance are defined by the specific type of inspection or test perform for the specific type of connection. When implemented, this program will ensure that the license renewal intended functions of the cable connections will be maintained consistent with the CLB.

Operating Experience. The "operating experience" program element criterion in SRP-LR Section A.1.2.3.10 states that operating experience should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the structure and component intended function(s) will be maintained during the period of extended operation.

The applicant stated in the LRA supplement for "operating experience" program element, that the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program is a new AMP for which there is no plant-specific program operating experience for program effectiveness. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. Future operating experience will be appropriately incorporated into the program. Industry operating experience that forms the basis for the program is described in the operating experience element of the GALL AMP XI.E6 program description.

In RAI B.2, dated May 22, 2008, the staff requested that the applicant justify why there are no operating experiences for components under the new programs.

In its response to RAI B.2, dated August 22, 2008, the applicant stated that the 2001 BVPS condition report identified the failure of a motor lead cable to lug connection and nearby lug joint due to long-term heating and corrosion. The corrective actions from the condition report included an extent of condition inspection of similar motor lead cable to lug connections; this inspection determined that the connections were satisfactory. Additionally, a self-assessment of the entire splice program, including engineering specifications, procedures, work practices, training, and stock review was performed. The self-assessment identified areas of concern and improvement that were entered into and resolved through the FENOC Corrective Action Program. The corrective actions from the self-assessment resulted in revisions to work and training procedures, drawing changes, stock procurement practices, and increased site awareness. The applicant also stated that LRA Section B.2.10, Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirement One-Time Inspection, under the operating experience, states that "industry and plant-specific operating experience will be evaluated in the development and implementation of this program. Future operating experience will be appropriately incorporated in the program." This second sentence differs slightly from a statement in other new AMP. Therefore, the applicant revised the LRA to make this operating experience statement consistent with the corresponding statement in the other new AMPs. The applicant revised LRA Section B.2.10, subsection "Operating Experience", second paragraph, second sentence, to read:

> Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating

experience is obtained, lesson learned will be appropriately incorporated into the program.

Based on its review, the staff finds the applicant's response to RAI B.2 acceptable because the applicant has identified the operating experience with components associated with the new AMP. The applicant's response included past corrective actions that provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the intended function(s) will be maintained during the period of extended operation. In addition, the applicant will evaluate industry and plant-specific operating in the development and implementation of this program and will incorporate lessons learned into the program, as additional operating experience is obtained. On this basis, the staff concludes that the applicant's operating experience element acceptable.

UFSAR Supplement. The applicant provided the UFSAR supplement for the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program in LRA Sections A.1.10 and in supplemental LRA Appendix A.2.1.40. The staff reviewed the UFSAR supplement and determines that it provides an adequate summary description of the program as required by 10 CFR 54.21(d). The staff also verified that applicant has committed (Commitment No. 3 in UFSAR Supplement Table A.4-1 and Commitment No. 3 in UFSAR Supplement Table A.5-1) to implement its new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program.

Conclusion. Based on its audit and review of the applicant's Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program and RAI response, the staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3). Based on its review of the UFSAR supplement for this program, the staff finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.2 Electrical Wooden Poles/Structures Inspection Program (Unit 2)

Summary of Technical Information in the Application. In LRA Section B.2.13, the applicant described the Electrical Wooden Poles/Structures Inspection Program (Unit 2 only) as a new plant-specific program that will be implemented prior to the period of extended operation. This program is applicable only to Unit 2. There are no in-scope electrical wooden poles/structures at Unit 1.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B.2.13 on the applicant's Electrical Wooden Poles/Structures Inspection Program (Unit 2 only) to ensure that the effects of aging, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff reviewed the Electrical Wooden Poles/Structures Inspection Program against the AMP elements found in SRP-LR Section A.1.2.3 and in SRP-LR Table A.1-1, focusing on how the program manages aging effects through effective incorporation of 10 elements (i.e., "scope of the program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," "corrective actions," "confirmation process," "administrative controls," and "operating experience").

The applicant indicated that program elements (7) “corrective actions,” (8) “confirmation process,” and (9) “administrative controls” are part of the site-controlled QA program. The staff’s evaluation of the QA program is found in SER Section 3.0.4. The staff’s evaluation of the applicant’s 10 program elements follows:

Scope of the Program. The “scope of the program” program element criterion found in SRP-LR Section A.1.2.3.1 states that the program scope should include the specific structures and components addressed with this program.

The staff reviewed the applicant’s program basis documents for this program element and found that a total of six poles comprise three H-frame structures (340436, 340437, 340438, 340439, 340440, 340441) and are all within the scope of the program. The staff found this program element acceptable since it specifically identifies the components within the scope of the Electrical Wooden Poles/Structures Inspection Program.

The staff determined that the specific components for which the program manages aging effects are identified, which satisfies the criterion defined in SRP-LR Section A.1.2.3.1. On this basis, the staff finds the applicant’s “scope of the program” element acceptable.

Preventive Actions. The “preventive actions” program element criterion in SRP-LR Section A.1.2.3.2 states that condition monitoring programs do not rely on preventive actions, and thus, preventive actions need not be provided.

The applicant described this AMP as a condition monitoring AMP. The program does not support preventive or mitigating actions. No actions are taken as part of this inspection to prevent or mitigate aging degradation. The staff considers inspection activities a means of detecting, not preventing, aging and, therefore, agrees that no preventive actions are associated with the wooden pole inspection activity and none are required.

The staff confirmed that the “preventive actions” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2. On this basis, the staff finds this program element acceptable.

Parameters Monitored or Inspected. The “parameters monitored/inspected” program element criterion in SRP-LR Section A.1.2.3.3 can be summarized as follows:

The parameters to be monitored or inspected should be identified and linked to the degradation of the particular SC intended function(s).

- For condition monitoring programs, the parameter monitored or inspected should detect the presence and extent of aging effects.

- For performance monitoring programs, a link should be established between degradation of the particular structure or component intended function(s) and the parameter being monitored.

- For prevention and mitigation programs, the parameter monitored should be the specific parameter being controlled to achieve prevention or mitigation of aging effects.

The applicant stated in the Electrical Wooden Poles/Structures Inspection Program (Unit 2 only) that the wooden poles are inspected for loss of material due to insect and woodpecker damage, reduced circumference, and moisture intrusion, and inspected for change in material properties due to moisture damage. The visual inspection portion of the activity also includes the cross-arms, guys, hardware, static supports, and insulators.

In RAI B.2.13-1, dated April 30, 2008, the staff requested that the applicant clarify the parameters of electrical wooden poles and/or structures that require inspection for aging effects and aging effects mechanisms affecting the ability of the wooden poles to perform their intended function and to explain how the buried part of the wooden pole would be monitored or inspected.

In its response to RAI B.2.13-1, dated June 6, 2008, the applicant stated that the buried portion of the pole will be partially excavated for cleaning, inspection, and preservative treatment.

Based on its review, the staff finds the applicant's response to RAI B.2.13-1 acceptable because the applicant has confirmed that it will provide guidance for visual inspections (entire exposed portion and ground-level/below grade), sounding, and boring (as necessary or select poles) to detect aging and other degradation that jeopardize the poles integrity and intended function such as, pole leaning or tilt; physical or mechanical damage; insect damage or infestations (wood pole); change in original grade; shell, butt, or internal rot or decay (wood pole); ground-line or below grade degradation; failure or degradation of reinforced portions; broken or damaged electrical equipment; oxide formations in advanced stages; delamination of steel plates; cracking (fatigue, stress, toe) caused by vibrations or manufacturing defects. Therefore, the staff's concern described in RAI B.2.13-1 is resolved.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. On this basis, the staff finds this program element acceptable.

Detection of Aging Effects. The "detection of aging effects" program element criterion in SRP-LR Section A.1.2.3.4 can be summarized as follows:

- Describe when, where, and how program data are collected (i.e., all aspects of activities to collect data as part of the program).
- Link the method or technique and frequency, if applicable, to plant-specific or industry wide operating experience.

The applicant stated in the Electrical Wooden Poles/Structures Inspection Program (Unit 2 only) that based on industry experience, the typical life of a wooden pole is 30-40 years. The applicant also stated that industry experience over several decades indicates that a 10-year inspection interval is adequate.

The staff reviewed the applicant's program basis documents for this program element and finds that the applicant's new inspection activity manages the aging for the electrical poles and structures within the scope of license renewal and includes direction on 'when', 'where', and 'how'. Specifically, the Electrical Wooden Poles/Structures Inspection Program (Unit 2 only) will schedule visual inspections and testing for the poles and structures every ten (10) years ('when'). The new inspection activity shall outline the scope of components to be inspected, including those identified within the scope of license renewal ('where'). Finally, as stated in the other elements, the new activity shall provide inspection guidance such as visual, effective circumference, sounding, boring, and excavation ('how'). The staff finds the applicant's proposed 10-year inspection interval acceptable because it is based on plant and industry experience.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4. On this basis, the staff finds this program element acceptable.

Monitoring and Trending. The "monitoring and trending" program element criterion in SRP-LR Section A.1.2.3.5 can be summarized as follows:

- Monitoring and trending activities should be described and provide predictability of the extent of degradation and thus effect timely corrective or mitigative actions.
- This program element describes how the data collected are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

The applicant stated in the Electrical Wooden Poles/Structures Inspection Program (Unit 2 only) that this is not a trending activity. The applicant further stated the 10-year inspection provides for timely identification of aging effects, with reports generated and responded to in a timely manner. The first inspection will be performed within a 5-year period, prior to the expiration of the current license.

The staff determined that for visual inspection, this program element satisfies the criteria of SRP-LR Section A.1.2.3.5. The staff finds that the applicant's first inspection will be performed within a 5-year period prior to the expiration of the current license and every 10 years after, based on industry experience. In-house reviews of the results shall be performed to confirm that the wooden poles are capable of continuing to perform their intended functions through the next inspection cycle. For these reasons, the staff finds the applicant's "monitoring and trending" program element acceptable.

Acceptance Criteria. The "acceptance criteria" program element criterion in SRP-LR Section A.1.2.3.6 can be summarized as follows:

- The acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation.

- The program should include a methodology for analyzing the results against applicable acceptance criteria.

- Qualitative inspections should be performed to the same predetermined criteria as quantitative inspections by personnel in accordance with the ASME Code and through approved site-specific programs.

The applicant stated in the Electrical Wooden Poles/Structures Inspection Program (Unit 2 only) that the acceptance criteria is no unacceptable indications of loss of material, or change in material properties are found as determined by a qualified inspector.

During the audit and review, the staff reviewed this program element from the applicant's program basis documents to determine whether it satisfies the criteria of SRP-LR Section A.1.2.3.6. The staff found that the applicant's Electrical Wooden Poles/Structures Inspection Program (Unit 2 only) procedure specified the inspection methods and any applicable acceptance or rejection criteria. In addition, the applicant will develop detailed qualification and experience requirements for personnel performing the inspections. The inspection results will be used to evaluate the capability of a degraded pole to assess its ability to continue performing its load-carrying intended functions. The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6. On this basis, the staff finds this program element acceptable.

<u>Corrective Actions</u>. The adequacy of the applicant's 10 CFR Part 50 Appendix B Program, associated with this program element, is discussed in SER Section 3.0.4.

The staff reviewed the other aspects of this program to determine whether or not it satisfies the criteria defined in SRP-LR Section A.1.2.3.7. The staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address corrective actions. On this basis, the staff finds this program element acceptable.

<u>Confirmation Process</u>. The adequacy of the applicant's 10 CFR Part 50, Appendix B Program, associated with this program element, is addressed in SER Section 3.0.4.
The staff reviewed the other aspects of this program to determine whether or not it satisfies the criteria defined in SRP-LR Section A.1.2.3.8. The staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address a confirmation process. On this basis, the staff finds this program element acceptable.

<u>Administrative Controls</u>. The adequacy of the applicant's 10 CFR Part 50, Appendix B Program, associated with this program element, is addressed in SER Section 3.0.4.

The staff reviewed the other aspects of this program element to determine whether or not it satisfies the criteria defined in SRP-LR Section A.1.2.3.9. The staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address administrative controls. On this basis, the staff finds this program element acceptable.

<u>Operating Experience</u>. The "operating experience" program element criteria in SRP-LR Section A.1.2.3.10 can be summarized as follows:

- Operating experience should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the SC intended function(s) will be maintained during the period of extended operation.

- The applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

The applicant stated in the Electrical Wooden Poles/Structures Inspection Program that this AMP is a new program and there is no plant-specific program operating experience for program effectiveness. Industry operating experience that forms the basis for the program is described in the operating experience element of the SRP-LR. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

During the audit and review, the staff reviewed the operating experience evaluation reports and also interviewed the applicant's technical personnel and confirmed that plant-specific operating experience revealed no degradation not bounded by industry experience. The applicant also indicated that as additional operating experience is obtained, lessons learned will be appropriately incorporated into the program. The staff determined that these operating experience events provide objective evidence that the Electrical Wooden Poles/Structures Inspection Program will provide timely detection of aging degradation and corrective action.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.10. On this basis, the staff finds this program element acceptable.

Based on its review of the operating experience and discussions with the applicant's technical staff, the staff concludes that the applicant's Electrical Wooden Poles/Structures Inspection Program will adequately manage the aging effects identified in the LRA for which this AMP is credited.

<u>UFSAR Supplement</u>. The applicant provided the UFSAR supplement for the Electrical Wooden Poles/Structures Inspection Program in LRA Section A.1.13. The staff reviewed this Section and finds the UFSAR supplement information an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. Based on its review of the applicant's Electrical Wooden Poles/Structures Inspection Program, the staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.3 Nickel-Alloy Nozzles and Penetrations Program

<u>Summary of Technical Information in the Application</u>. In LRA Section B.2.28, the applicant described the Nickel-Alloy Nozzles and Penetrations Program as a condition monitoring program designed to manage the effects of PWSCC in nickel-alloy RCPB components (other in the RV closure head penetration nozzles) for Units 1 and 2.

<u>Staff Evaluation – Regulatory Assessment Criteria</u>. In the GALL Report, Volume 2, Tables IV.A2 and IV.C2, the staff recommends that an applicant's Water Chemistry Program and ASME Code Section XI, Subsections IWB, IWC, and IWD Program be credited to manage cracking due to PWSCC of nickel-alloy RV components, piping components, pressurizer components, and some SG components (including any associated nickel-alloy welds) in the RCPB. For these

components, the staff also recommends that an applicant provide a commitment on the application to:

> Comply with applicable NRC Orders and provide a commitment in the FSAR supplement to submit a plant-specific AMP to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.

This approach to aging management conforms to the staff's recommended aging management guidelines provided in the following sections of the SRP-LR:

- Section 3.1.2.2.13 – Cracking due to Primary Water Stress Corrosion Cracking (PWSCC)
- Section 3.1.2.2.16 – Cracking due to Primary Water Stress Corrosion Cracking (PWSCC) (applicable to steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with nickel-alloy and nickel-alloy pressurizer spray heads)

This recommended aging management approach does not apply to the nickel-alloy materials used in the fabrication of upper RV closure head penetration nozzles and welds, SG tubes, SG sleeves, SG plugs, or SG divider plates. For these nickel-alloy components, the GALL Report has different aging management recommendations which may be found in the applicable AMRs in GALL Report Tables IV.A2 for RV components or IV.D1 for recirculating SG designs.

Staff Evaluation. The staff reviewed the information in LRA Section B.2.28, the applicant's license renewal basis document for this AMP, and other supporting information and documents that pertain to the procedural and implementation controls for this AMP, against the regulatory criteria summarized in the above Staff Evaluation section.

The staff noted that, in LRA Tables 3.1.2-1 3.1.2-3, the applicant credited its Nickel-Alloy Nozzles and Penetrations Program, as the basis for managing cracking due to PWSCC in the majority of the nickel-alloy component commodity groups used in the fabrication of the RVs, pressurizers, Class 1 piping systems, and SGs for Units 1 and 2. The staff also noted that the applicant's Nickel-Alloy Nozzles and Penetration Program does not have a specific corresponding program in the GALL Report, Volume 2, Chapter XI. The staff determined that that if the applicant was tying its basis for aging management to the Nickel-Alloy Nozzles and Penetrations Program, then the AMP must be defined as plant-specific in the LRA.

In RAI B.2.28-1, dated June 5, 2008, the staff requested that the applicant justify why the Nickel-Alloy Nozzles and Penetration Program had not been identified as a plant-specific AMP and the program elements for this AMP provided in the LRA. (Note: The staff evaluates the applicant's response to RAI B.2.28-1 later in this evaluation in conjunction with the staff's evaluation of the applicant's response to RAI B.2.28-2).

The staff reviewed the applicant's response and finds that it adequately identified that intent of the Nickel-Alloy Nozzles and Penetrations Program was to commit toward development of a plant-specific AMP as stated in LRA Section A.1.28. The commitment includes the implementation of NRC Orders, Bulletins and GLs, and staff-accepted industry guidelines. This clarification removed the perceived linkage to the applicant's stated Nickel-Alloy Nozzles and

Penetrations Program, which was only included as a review guide and therefore no program elements are described. Therefore, the staff's concern described in RAI B.2.28-1 is resolved.

The staff noted that in the specific AMR items for PWR nickel-alloy components in GALL Report Tables IV.A2, IV.C2, and IV.D1, the staff recommends that the type of commitment mentioned in the staff evaluation be credited, in part, as the basis for managing the effects of aging for the a vast majority of the nickel-alloy components within the scope of the LRA. The staff reviewed the technical and regulatory information in the Nickel-Alloy Nozzles and Penetrations Program and verified that the applicant had provided the following commitments for its nickel-alloy components in LRA Table A.4-1 for Unit 1 (Commitment No. 15) and in LRA Table A.5-1 for Unit 2 (Commitment No. 17):

> For the Nickel-Alloy Nozzles and Penetrations Program, regarding activities for managing the aging of nickel-alloy components and nickel-alloy clad components susceptible to primary water stress corrosion cracking - PWSCC (other than upper reactor vessel closure head nozzles and penetrations), BVPS commits to develop a plant-specific aging management program that will implement applicable: 1. NRC Orders, Bulletins and Generic Letters; and, 2. Staff-accepted industry guidelines.

The staff noted, however, that the applicant did not specifically identify which nickel-alloy component commodity groups at Units 1 and 2 were specifically within the scope of the applicant's Nickel-Alloy Nozzles and Penetrations Program and these regulatory commitments.

In RAI B.2.28-2, dated June 5, 2008, the staff requested that the applicant clarify which nickel-alloy component commodity groups at Units 1 and 2 are within the scope of the applicant's Nickel-Alloy Nozzles and Penetrations Program and the scope of LRA Commitments No. 15 and No. 17 for Unit 1 and Unit 2, respectively.

In its response to RAIs B.2.28-1 and B.2.28-2, dated July 21, 2008 the applicant stated that the Nickel-Alloy Nozzles and Penetrations Program was not intended to be defined as an AMP with the 10 program elements recommended in SRP-LR Section A.1.2.3. The applicant clarified that, instead, the Nickel-Alloy Nozzles and Penetrations Program was intended to identify and establish the applicable commitment for nickel-alloy components other than those in the upper RV closure head, as recommended in GALL Report Tables IV.A2 for PWR RV components, IV.C2 for PWR piping and pressurizer components, and IV.D1 for recirculating SG components. The applicant explained that Nickel-Alloy Nozzles and Penetrations Program was incorporated into the LRA only to establish the wording for the LRA's commitments for ASME Code Class 1 nickel-alloy components and pressure retaining welds and to simplify identification and review of the relevant AMRs in the application.

The applicant explained that in order to resolve this issue, it amended the LRA for BVPS to delete the Nickel-Alloy Nozzles and Penetrations Program and to revise UFSAR Supplement Section A.1.28. The applicant also stated that, in order to properly cross-reference to the appropriate commitments, the relevant AMRs in LRA Tables 3.1.2-1 are amended to delete references to the Nickel-Alloy Nozzles and Penetrations Program, and instead, include references to the commitments provided in UFSAR Supplement Tables A.4-1 for Unit 1 (Commitment No. 15) and A.5-1 for Unit 2 (Commitment No. 17). The staff verified that the applicant has made the applicable amendments of the LRA.

Based on its review, the staff finds that the applicant's responses to RAIs B.2.28-1 and B.2.28-2 are acceptable because the applicant has amended the LRA to delete the Nickel-Alloy Nozzles and Penetrations Program and the UFSAR supplement for this AMP from the scope of license renewal and has amended the AMR items for the nickel-alloy Class 1 components to directly refer to the applicant's aging management commitments for ASME Code Class 1 nickel-alloy components and pressure retaining welds. Therefore, the staff's concerns described in RAIs B.2.28-1 and RAI 2.28-2 are resolved.

With respect to the acceptability of these commitments, the staff finds the provisions of LRA Commitments No. 15 for Unit 1 and No. 17 for Unit 2 acceptable because they conform to the commitment criteria recommendations discussed in the Staff Evaluation Section of this evaluation. The staff also verified that LRA Table A.4-1 indicates that Commitment No. 15 for Unit 1 is scheduled for implementation by January 29, 2016, and that Commitment No. 17 for Unit 2 is scheduled for implementation by May 27, 2027. The staff finds these implementation dates acceptable for aging management during the period of extended operation because the operating licenses for Units 1 and 2 will expire on January 29, 2016 and May 27, 2027, respectively.

Thus, the staff finds that the applicant's revised aging management basis for the ASME Code Class 1 nickel-alloy components acceptable because: (a) the relevant AMRs for these nickel-alloy components appropriately reflect and credit the applicant Water Chemistry Program, ASME Code Section XI Inservice Inspection, Subsections IWB, IWC and IWD Program; (b) the applicable AMRs have been amended to delete references to Nickel-Alloy Nozzles and Penetrations Program and instead to point directly to the applicant commitments for nickel-alloy components and pressure retaining welds provided in UFSAR Supplement Table A.4-1 for Unit 1 (Commitment No.15) and UFSAR Supplement Table A.5-1 for Unit 2 (Commitment No. 17); and (c) the change in the AMRs makes the AMRs for these components consistent with the AMRs for nickel-alloy components described in the GALL Report Revision 1, Volume 2, Tables IV.A2, IV.C2, and IV.D1.

Since the staff has accepted the applicant's basis for deleting this AMP from the LRA, the staff finds that there is no reason to perform a program element- by- program element evaluation of the Nickel-Alloy Nozzles and Penetrations Program that was originally docketed in the LRA.

Operating Experience. The staff noted that the industry experience identified in NRC Bulletins 2003-02 and 2004-02 is applicable to the applicant's Nickel-Alloy Nozzles and Penetrations Program. The staff considers this AMP to be an existing program because the applicant is already implementing its current regulatory commitments for non-RV closure head penetration nozzle nickel-alloy components, as confirmed in its responses to NRC Bulletin 2003-02, dated September 19, 2003, December 2, 2003, December 29, 2004, and May 24, 2005, and to NRC Bulletin 2004-01 dated July 27, 2004, December 29, 2004, and May 19, 2005.

In RAI B.2.28-3, Part A, dated June 5, 2008, the staff requested that the applicant clarify whether NRC Bulletins 2003-02 and 2004-01, the applicant's responses to these Bulletins, and any regulatory commitments made in response to these Bulletins are within the scope of the applicant's Nickel-Alloy Nozzles and Penetrations Program and the license renewal commitment(s) for this program for Unit 1 or Unit 2.

The staff also determined as part of its review of the CLB that on February 27, 2007, the applicant provided a supplemental commitment on monitoring activities for nickel-alloy dissimilar metal welds used in the Unit 1 pressurizer design, and that the NRC approved these actions in a Confirmatory Action Letter dated March 20, 2007.

In RAI B.2.28-3, Part B, dated June 5, 2008, the staff requested that the applicant clarify whether its letter of February 27, 2007 and any commitments or actions made in this letter, and staff's basis for approval in the Confirmatory Action Letter of March 20, 2007, are within the scope of the applicant's Nickel-Alloy Nozzles and Penetrations Program and the applicable license renewal commitment(s) for this program for Unit 1 or Unit 2.

In RAI B.2.28-3, Part C, dated June 5, 2008, the staff requested that the applicant identify any additional NRC generic communications, and BVPS specific response and commitments made to these additional generic communications that are within the scope of the applicant's Nickel-Alloy Nozzles and Penetrations Program and the applicable license renewal commitments for this program (*i.e.*, Commitment No. 15 for Unit 1 and/or to Commitment No. 17 for Unit 2).

In its response to RAI B.2.28-3, Parts A, B, and C, dated July 21, 2008, the applicant stated that the LRA Section B.2.28 was not intended to be a defined AMP with 10 elements. The applicant clarified that, instead, the Nickel-Alloy Nozzles and Penetrations Program was intended to identify and establish the applicable commitment for nickel-alloy components other than those in the upper RV closure head, as recommended in the GALL Report Tables IV.A2 (for PWR RV components), IV.C2 (for PWR piping and pressurizer components), and IV.D1 (for PWR recirculating SG components). The applicant explained that Nickel-Alloy Nozzles and Penetrations Program was not intended to be an AMP per se, but instead was incorporated into the LRA only to establish the commitment wording for the LRA and to simplify identification and review of the relevant AMRs in the application.

The applicant explained that in order to resolve this issue, it has amended the LRA for BVPS to delete the Nickel-Alloy Nozzles and Penetrations Program and to revise UFSAR Supplement Section A.1.28. The applicant also stated that, in to order properly cross-reference to the appropriate commitments, the relevant AMRs in LRA Tables 3.1.2-1 are amended to delete references to the Nickel-Alloy Nozzles and Penetrations Program, and instead, include references to the commitments provided in UFSAR Supplement Tables A.4-1 for Unit 1 (Commitment No. 15) and A.5-1 for Unit 2 (Commitment No.17). The staff confirmed that the applicant has made the applicable amendments to the LRA.

Based on its review, the staff finds the applicant's response to RAI B.2.28-3, Parts A, B, and C acceptable because that applicant has amended the LRA to delete the Nickel-Alloy Nozzles and Penetrations Program and the AMR items for the nickel-alloy Class 1 components to directly refer to the applicant's aging management commitments for these components. The staff also finds the applicant's response acceptable because the scope of the applicant's commitments in LRA Tables A.4-1 for Unit 1 (Commitment No. 15) A.5-1 for Unit 2 (Commitment No.17) include the applicant's: (a) past commitments in response to applicable NRC Orders, Bulletins and GLs on nickel-alloy component cracking (as discussed the paragraphs below), (b) future commitments made to any NRC Orders, Bulletins and GLs on nickel-alloy component cracking that may be issued in the future and/or (c) commitments to staff-accepted industry guidelines on management of cracking in Class 1 nickel-alloy component during the period of extended operation. Therefore, the staff's concerns raised in RAI B.2.28-3, Parts A, B, and C are resolved.

The staff noted that the current NRC generic communications that relate to aging management of cracking in the nickel-alloy components for Units 1 and 2 are NRC Order EA-03-009 (February 11, 2003), as amended in First Revised NRC Order EA-03-009 (February 20, 2004), applicable to cracking of nickel-alloy base metal nozzles and pressure retaining welds in PWR upper RV closure heads; NRC Bulletin 2003-02 (August 21, 2003), applicable cracking in PWR RV bottom mounted instrumentation nozzles with nickel-alloy pressure retaining welds; and NRC Bulletin 2004-01 (May 28, 2004), applicable to cracking in nickel-alloy components and pressure retaining welds in PWR pressurizers. These documents are publicly available at the following NRC public web site web addresses:

> http://www.nrc.gov/reactors/operating/ops-experience/vessel-head-degradation/vessel-head-degradation-files/order-rpv-inspections.pdf
>
> http://adamswebsearch2.nrc.gov/idmws/doccontent.dll?library=PU_ADAMS^PBNTAD01&ID=042010213
>
> http://www.nrc.gov/reading-rm/doc-collections/gen-comm/bulletins/2003/bl03002.pdf
>
> http://adamswebsearch2.nrc.gov/idmws/doccontent.dll?library=PU_ADAMS^PBNTAD01&ID=041530271

The staff verified that the applicant's responses and commitments in the CLB to the applicable NRC Orders, Bulletins, or GLs on nickel-alloy component cracking are publicly available at the following NRC public web site web addresses:

> http://www.nrc.gov/reactors/operating/ops-experience/pressure-boundary-integrity/upper-head-issues/order-ea-03-009.html#region1
>
> http://www.nrc.gov/reactors/operating/ops-experience/pressure-boundary-integrity/bottom-head-issues/bulletin-2003-02.html#region1
>
> http://www.nrc.gov/reactors/operating/ops-experience/pressure-boundary-integrity/pressurizer-issues/bulletin-2004-01.html

The staff also verified that the applicant's augmented activities for its ASME Code Class 1 nickel-alloy components includes commitments made in the applicant's responses to these generic communications. Based on this review and verification, the staff finds that the applicant's responses to these generic communications provide clear evidence that the applicant has incorporated applicable BVPS-specific and generic industry-wide experience to address cracking of the ASME Code Class 1 nickel-alloy components for Units 1 and 2, and has placed appropriate regulatory commitments for these components as part of its CLB.

Therefore, the staff concludes that the applicant has provided an acceptable basis for managing cracking of these components because the applicant has incorporated its current regulatory commitments for these nickel-alloy components into LRA Commitment No. 15 for Unit 1 and LRA Commitment No. 17 for Unit 2.

UFSAR Supplement. The applicant provided the UFSAR supplement for its Nickel-Alloy Nozzles and Penetrations Program in LRA Section A.1.28. The staff confirms that UFSAR Supplement A.1.28 is no longer required for the Nickel-Alloy Nozzles and Penetrations Program because, in its letter of July 21, 2008, the applicant amended the LRA to delete the Nickel-Alloy Nozzles and Penetrations Program and UFSAR Supplement A.1.28 for the Nickel-Alloy Nozzles and Penetrations Program from the scope of the LRA. The staff also confirms that the applicant has amended the AMR items for the nickel-alloy Class 1 components to directly refer to its aging management commitments, described in UFSAR Supplement Tables A.4-1 for Unit 1 (Commitment No. 15) and A.5-1 for Unit 2 (Commitment No.17). The staff finds that these commitments provide an acceptable basis for managing cracking in the applicant's ASME Code Class 1 nickel-alloy components and pressure retaining welds because placement of the commitments on the LRA is consistent with the staff's aging management guidance in SRP-LR Sections 3.1.2.2.15 and 3.1.2.2.17 and in the applicable AMRs for these components in the GALL Report, Revision 1, Volume 2, Tables IV.A2, IV.C2, and IV.D1.

Conclusion. Based on its review of the applicant's Nickel-Alloy Nozzles and Penetrations Program, the staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement and finds that, instead of including a UFSAR supplement for the AMP, the applicant has provided an acceptable basis for amending the LRA to delete this AMP and UFSAR supplement for this AMP from the scope of the LRA, and instead, include applicable commitments for these nickel-alloy components, as described UFSAR Supplement Tables A.4-1 for Unit 1 (Commitment No. 15) and A.5-1 for Unit 2 (Commitment No.17). The staff concludes this to be an acceptable alternative method of satisfying the UFSAR supplement requirements of 10 CFR 54.21(d).

3.0.3.3.4 Reactor Vessel Integrity Program

Summary of Technical Information in the Application. In LRA Section B.2.35, the applicant described the existing Reactor Vessel Integrity Program as a plant-specific program.

The Reactor Vessel Integrity Program manages loss of fracture toughness due to neutron embrittlement in reactor materials exposed to a neutron fluence exceeding 1.0E+17 n/cm^2 (E>1.0 MeV). The program is based on 10 CFR Part 50, Appendix H, "Reactor Vessel Material Surveillance Requirements," and ASTM E185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels" (incorporated by reference into 10 CFR 50, Appendix H). The program periodically removes capsules during the course of plant operating life to evaluate neutron embrittlement through surveillance capsule testing and evaluation, fluence calculations, and monitoring of effective full-power years (EFPYs). Best-estimate values of RV accumulated neutron fluence are determined by analytical models that satisfy the guidance of Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." The applicant utilizes data from the program to determine:

- pressure-temperature (P-T) limits, minimum temperature requirements, and end-of-life Charpy upper-shelf energy in accordance with 10 CFR Part 50, Appendix G, “Fracture Toughness Requirements”
- end-of-life reference temperature for pressurized thermal shock (RT_{PTS}) values in accordance with 10 CFR 50.61, “Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock”

The Reactor Vessel Integrity Program guides withdrawal and testing or storage of material specimen capsules. All withdrawn capsules were tested and stored. Standby capsules at Units 1 and 2, available for future testing, will be removed from the vessels when the neutron fluences are approximately equivalent to the projected vessel wall neutron fluence at 60 years of operation (corrected for lead and capacity factors). In addition, the Reactor Vessel Integrity Program implements flux reduction programs as required by 10 CFR 50.61.

Staff Evaluation. In LRA Section B.2.35, Amendment 1, dated February 12, 2008, the applicant described its program for managing the effects of aging on the fracture toughness properties for low-alloy steels in the RVs for Units 1 and 2. This AMP description includes a discussion of the RV surveillance programs for Units 1 and 2. The applicant stated that its methods for monitoring the effects of neutron embrittlement will comply with 10 CFR Part 50, Appendix H and ASTM E 185-82, “Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels,” which is incorporated by reference into 10 CFR Part 50, Appendix H.

This AMP evaluates neutron embrittlement for all RV materials with projected neutron exposure greater than 10^{17} n/cm^2 (E > 1.0 MeV) after 60 years of operation. The AMP monitors changes in the RV materials’ upper shelf energy (USE) values and nil-ductility transition temperature (RT_{NDT}) values for the purpose of supporting the development of P-T limit curves and pressurized thermal shock assessments. USE and RT_{NDT} values are calculated using RG 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials.”
The calculation methodologies in RG 1.99, Revision 2 prescribe the use of either chemistry data from the RG or credible plant-specific surveillance capsule data.

The staff reviewed the applicant’s description of its RV Integrity AMP for Units 1 and 2 to determine whether the AMP is adequate for managing the effects of aging on the RVs. The staff confirmed that the applicant’s description of the RV surveillance program for Units 1 and 2 in the Reactor Vessel Integrity Program is consistent with GALL AMP XI.M31, “Reactor Vessel Surveillance.” The applicant’s Reactor Vessel Integrity Program description includes a discussion of specific aspects of the RV surveillance capsule withdrawal schedules for Units 1 and 2 for the period of extended operation. Surveillance Capsules U, V, W, and Y were removed from the Unit 1 RV and tested. There is currently one surveillance capsule (Surveillance Capsule X) and three standby surveillance capsules (Surveillance Capsules T, Z, and S) remaining in the Unit 1 RV. UFSAR Table 4.5-3 for Unit 1 documents the withdrawal time for Surveillance Capsule X as 25.9 EFPY, based on a projected capsule neutron fluence of 5.87 x 10^{19} n/cm^2 (E > 1.0 MeV), which is equivalent to the peak RV inner wall exposure at 45 EFPY. The estimated Surveillance Capsule X withdrawal date is 2013. The withdrawal and testing of Surveillance Capsule X satisfies ASTM E185-82 specifications for the original 40-year license term. The three standby surveillance capsules will be exposed to additional neutron flux, providing a source for future surveillance data that will be used to monitor neutron embrittlement for the extended period of operation. The applicant has removed and tested Surveillance Capsules U, V, W, and X at Unit 2. No additional capsules are required to satisfy the ASTM E 185-82 specifications for the original 40-year license term. Two standby surveillance capsules (Surveillance Capsules Y and Z) remain in the Unit 2 RV. The applicant stated that one of these capsules will be removed at a peak neutron fluence exposure of approximately 8.48×10^{19} n/cm^2 (E > 1.0 MeV), which corresponds to the peak RV inner wall exposure at 72 EFPY. The corresponding capsule withdrawal time is 23.5 EFPY, and the projected withdrawal date is 2014. The applicant stated that the second capsule will remain in the RV to provide neutron fluence monitoring and will be available for future testing.

The staff found that the applicant's description of the Reactor Vessel Integrity Program for Units 1 and 2 acceptable because the surveillance program design, the capsule withdrawal schedule, and the evaluation of test results are consistent with ASTM E185-82. As capsules are withdrawn from the RV, specimens are stored for future reconstitution, if needed. The program manages the remaining standby capsules to achieve the withdrawal of at least one capsule when the capsule neutron fluence is greater than, but less than two times, the 60-year maximum RV neutron fluence. The remaining standby capsules will be managed for optimal neutron exposure and meaningful metallurgical data, if additional license renewals are sought. The program manages the review and updating of 60-year neutron fluence projections to support the preparation of new P-T limit curves and RT_{PTS} calculations for altered RV exposure conditions.

The staff noted that the applicant included a statement in the Reactor Vessel Integrity Program indicating that the AMP requires all surveillance specimens removed from RVs for Units 1 and 2, both tested and untested, to remain in storage.

In RAI B.2.35-1, dated March 21, 2008, the staff requested that the applicant provide a formal commitment to implement this requirement.

Specifically, the staff requested the applicant provide a commitment to store and maintain standby surveillance capsules in a condition that would permit their future use through the end of the period of extended operation.

In its response to RAI B.2.35-1, dated April 18, 2008, the applicant stated that it has added Commitment No. 27 to LRA Table A.4-1 (Unit 1) and Commitment No. 30 to LRA Table A.5-1 (Unit 2). Both commitments read as follows:

> As part of the Reactor Vessel Integrity Program, FENOC [the applicant] will store and maintain standby surveillance capsules in a condition that would permit their future use through the end of the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI B.2.35-1 acceptable because the applicant has added commitments to the LRA for Units 1 and 2 to store and maintain standby surveillance capsules in a condition that would permit their future use through the end of the period of extended operation. The staff confirms that the applicant has added these commitments to LRA Tables A.4-1 (Unit 1) and A.5-1 (Unit 2) as part of Amendment No. 6 to the LRA. Therefore, the staff's concern described in RAI B.2.35-1 is resolved.

In LRA B.2.35, the applicant also discussed its Operating Experience Program element as part of its description of the Reactor Vessel Integrity Program. The applicant stated in its discussion of this program element that the AMP has provided materials data and dosimetry for monitoring of radiation embrittlement since plant startup. The staff has approved the use of this program for the current 40-year license term. Surveillance capsules have been withdrawn during the current operating period, and the data from these surveillance capsules have been used to verify and project the embrittlement behavior of RV beltline materials. Calculations have been performed as required to project RT_{NDT} for PTS and USE values at the end of the period of extended operation. P-T limit curves assure reactor coolant system operation within required safety margins, and are revised prior to exceeding specified RV neutron fluence limits. The applicant discussed actions to manage the RV neutron fluence at the location of the limiting material (Lower Shell Plate B6903-1) in the RV for Unit 1. Starting with RFO 11 (1995), the applicant instituted a neutron flux management program to manage the effects of the neutron fluence on the RT_{PTS} value for the limiting RV material at Unit 1. The applicant also described enhancements made to the Reactor Vessel Integrity Program as a result of its self-assessment of the program in 2001. These program enhancements enabled the applicant to better document and control technical information used within the program and provides reasonable assurance that the Reactor Vessel Integrity Program is effective. The staff confirmed that the applicant's discussion of the Operating Experience Program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

Based on its description of the program and its response to RAI B.2.35, the staff determines that the applicant's Reactor Vessel Integrity Program for Units 1 and 2 is acceptable because: (a) the proposed surveillance capsule withdrawal schedule provides reasonable assurance that neutron-induced embrittlement in low-alloy steel RV base metals and their associated welds will be adequately monitored during the extended period of operation; and (b) the applicant's RV surveillance program for Units 1 and 2 complies with the requirements of the 10 CFR Part 50, Appendix H.

UFSAR Supplement. The applicant provided the UFSAR supplement summary description for the Reactor Vessel Integrity Program in LRA Section A.1.35. The staff reviewed this Section and determined that the information in the supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. Based on its review of the applicant's Reactor Vessel Integrity Program, the staff finds that the program elements are consistent with GALL AMP XI.M31. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.5 Settlement Monitoring Program (Unit 2)

Summary of Technical Information in the Application. In LRA Section B.2.37, the applicant described the Settlement Monitoring Program (Unit 2 only) as an existing plant-specific condition monitoring program for structures and piping that are within the scope of license renewal.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B.2.37 on the applicant's Settlement Monitoring Program (Unit 2 only) to ensure that the effects of aging, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff reviewed the Settlement Monitoring Program (Unit 2 only) against the AMP elements found in the SRP-LR Section A.1.2.3 and in SRP-LR Table A.1-1, focusing on how the program manages aging effects through the effective incorporation of 10 elements (*i.e.*, "scope of the program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," "corrective actions," "confirmation process," "administrative controls," and "operating experience").

The applicant indicated that program elements (7) "corrective actions," (8) "confirmation process," and (9) "administrative controls" are parts of the site-controlled QA program. The staff's detailed evaluation of the QA program is documented in SER Section 3.0.4. Evaluations of the ten program elements follow.

Scope of the Program. The "scope of the program" program element criterion in SRP-LR Section A.1.2.3.1 requires that the program scope include the specific structures and components addressed with this program.

The staff reviewed the applicant's program basis documents for this program element and found that the program is applicable to the Unit 2 valve pit (although there are two Unit 2 valve pits, only one is affected), safeguards building, and refueling water storage tank (RWST) foundation.

In RAI 4.7.5-1, dated April 1, 2008, the staff requested that the applicant provide the list of structures that were initially within the scope of the Settlement Monitoring Program (Unit 2 only) and the basis for which monitoring has been discontinued.

In its response to RAI 4.7.5-1, dated April 30, 2008, the applicant stated all of Unit 2 Category I safety-related structures have been determined to be "stable" with the exception of the RWST pad and shield wall, safeguards area building, and valve pit.

Based on its review, the staff finds the applicant's response to RAI 4.7.5-1 acceptable because the applicant has adequately described the list of structures that were initially within the scope of the Settlement Monitoring Program (Unit 2 only) and the basis for which monitoring has been discontinued. Therefore, the staff's concern described in RAI 4.7.5-1 is resolved.

The staff reviewed UFSAR Section 2.5.4.13 and notes that the applicant monitored the settlement of each Unit 2 Category I structure during construction and will continue monitoring throughout the life of the plant, until the settlement for a particular structure has been determined stable, as defined by the Settlement Monitoring Program (Unit 2 only). For such structures, the applicant will discontinue settlement monitoring. The staff notes that the RWST pad and shield wall, safeguards area building, and valve pit have not yet maintained a "fixed" elevation and; therefore, continue to be monitored in accordance with the Settlement Monitoring Program (Unit 2 only). The LRA identifies which structures are managed by the program, which satisfies the criterion defined in SRP-LR Section A.1.2.3.1. On this basis, the staff finds the applicant's "scope of the program" element acceptable.

Preventive Actions. The "preventive actions" program element criterion in SRP-LR Section A.1.2.3.2 states that condition monitoring programs do not rely on preventive actions, and thus, preventive actions need not be provided.

The staff finds this program element acceptable because this is a condition monitoring program and there is no need for preventive actions. The staff confirms that the "preventive action" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2. On this basis, the staff finds the applicant's "preventive actions" element acceptable.

Parameters Monitored or Inspected. The "parameters monitored/inspected" program element in SRP-LR Section A.1.2.3.3 can be summarized as follows:

The parameters to be monitored or inspected should be identified and linked to the degradation of the particular SC intended function(s).

- For condition monitoring programs, the parameter monitored or inspected should detect the presence and extent of aging effects.

- For performance monitoring programs, a link should be established between degradation of the particular structure or component intended function(s) and the parameter being monitored.

- For prevention and mitigation programs, the parameter monitored should be the specific parameter being controlled to achieve prevention or mitigation of aging effects.

The staff reviewed the applicant's program basis documents for this program element and the staff finds that the applicant has identified the elevations of buildings that are surveyed and compared to previously recorded elevations. Any changes in elevations are evaluated with respect to previously established limits on changes in structure elevations.

The staff confirms that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. On this basis, the staff finds this program element acceptable.

Detection of Aging Effects. The "detection of aging effects" program element in SRP-LR Section A.1.2.3.4 SRP-LR can be summarized as follows:

- Provide information that links the parameters to be monitored or inspected to the aging effects being managed.
- Describe when, where, and how program data are collected (*i.e.*, all aspects of activities to collect data as part of the program).
- Link the method or technique and frequency, if applicable, to plant-specific or industry wide operating experience.

- Provide the basis for the inspection population and sample size when sampling is used to inspect a group of SCs. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects.

The staff reviewed the applicant's program basis documents for this program element and finds that the applicant used surveys to measure structure settlement. If the settlement of a structure exceeds anticipated levels, the applicant is required to review the current analysis.

In RAI 4.7.5-2, dated April 1, 2008, the staff requested that the applicant provide a list of safety-related piping systems that are subject to differential structure settlement of the attached structures.

In its response to RAI 4.7.5-2, dated April 30, 2008, the applicant stated that there are no safety-related piping systems monitored for differential settlement. If the settlement of a structure exceeds anticipated levels, a review of the current analysis (as it relates to the integrity of the structure and the maintenance of settlement assumptions in the associated piping stress analyses) is required.

Based on its review, the staff finds the applicant's response to RAI 4.7.5-2 acceptable because the applicant has verified that there are no safety-related piping systems monitored for differential settlement. Therefore, the staff's concern described in RAI 4.7.5-2 is resolved.

The staff notes that in LRA Section 4.7.5, the applicant's Settlement Monitoring Program ensures that the current 40-year settlement assumptions in the Unit 2 pipe stress analyses are maintained for the period of extended operation. Sixty-year differential settlement projections are not provided since the TLAAs associated with the subject Unit 2 piping stress analyses have been dispositioned in accordance with 10 CFR 54.21(c)(1)(iii). The aging effects managed by the program are identified and linked to the parameters monitored, which satisfies the criterion defined in SRP-LR Section A.1.2.3.4. On this basis, the staff finds the applicant's "detection of aging effects" of the program acceptable.
Monitoring and Trending. The "monitoring and trending" program element in SRP-LR Section A.1.2.3.5 can be summarized as follows:

- 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.
- This program element describes how the data collected are evaluated and may also include trending for a forward look. The parameter or indicator trended should be described.

The staff reviewed the applicant's program basis documents for this program element and finds that the program manages TLAAs established to maintain component stress levels within the capabilities of the associated components. The staff also finds that the applicant's settlements of structures are trended incrementally to measure and predict the extent of settling.

The staff confirms that the “monitoring and trending” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5. On this basis, the staff finds this program element acceptable.

Acceptance Criteria. The “acceptance criteria” program element in SRP-LR Section A.1.2.3.6 can be summarized as follows:

- The acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended function(s) are maintained under all CLB design conditions during the period of extended operation.
- The program should include a methodology for analyzing the results against applicable acceptance criteria.
- Qualitative inspections should be performed to the same predetermined criteria as quantitative inspections by personnel in accordance with the ASME Code and through approved site-specific programs.

The staff reviewed the applicant’s program basis documents for this program element and finds that each monitored structure has an allowable settlement limit. And the applicant’s Structure Settlement Evaluation is a comparison of observed structure settlement to that anticipated by the original plant designer or that amount of settlement later determined to be acceptable by more recent analyses. The program requires action to be taken if there are discrepancies between measured and anticipated settlements.

The staff confirms that the “acceptance criteria” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6. On this basis, the staff finds this program element acceptable.

Corrective Actions. The adequacy of the applicant’s 10 CFR Part 50, Appendix B Program, associated with this program element, is addressed in SER Section 3.0.4.

The staff reviewed the other aspects of this program to determine whether or not it satisfies the criteria defined in SRP-LR Section A.1.2.3.7. The staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address corrective actions. On this basis, the staff finds the applicant’s “corrective actions” element acceptable.

Confirmation Process. The adequacy of the applicant’s 10 CFR Part 50, Appendix B Program, associated with this program element, is addressed in SER Section 3.0.4.

The staff reviewed the other aspects of this program to determine whether or not it satisfies the criteria defined in SRP-LR Section A.1.2.3.8. The staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address a confirmation process. On this basis, the staff finds the applicant’s “confirmation process” element acceptable.

Administrative Controls. The adequacy of the applicant’s 10 CFR Part 50, Appendix B Program, associated with this program element, is addressed in SER Section 3.0.4.

The staff reviewed the other aspects of this program element to determine whether or not it satisfies the criteria defined in SRP-LR Section A.1.2.3.9. The staff finds the requirements of

10 CFR Part 50, Appendix B, acceptable to address administrative controls. On this basis, the staff finds the applicant's "administrative controls" element acceptable.

Operating Experience. The "operating experience" program element criteria in SRP-LR Section A.1.2.3.10 can be summarized as follows:

- Operating experience should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the SC intended function(s) will be maintained during the period of extended operation.
- The applicant may have to commit to providing operating experience in the future for new programs to confirm their effectiveness.

The staff reviewed the applicant's program basis documents for this program element.

In RAI 4.7.5-3, dated April 1, 2008, the staff requested that the applicant identify which structures were discontinued, and the basis for discontinuing this monitoring.

In its response to RAI 4.7.5-3, dated April 30, 2008, the applicant provided a list of the safety-related structures for Unit 2 with settlement markers that were determined to be stable and for which monitoring was discontinued. Those structures include the auxiliary building, diesel generator building, emergency outfall structure, fuel and decontamination building, primary plant demineralized water tank pad and enclosure, reactor containment building, control room extension, service building, main steam and cable vault, and the intake structure. The applicant also stated that the Settlement Monitoring Program is applicable only to Unit 2. Within that program, a settlement marker location is considered stable if, over a reasonable time frame (2 to 3 years, or 730 to 1095 days), a trend can be established that shows the marker has maintained a "fixed" elevation within a tolerance range of plus or minus 0.125 inch (plus or minus 1/8th inch).

Based on its review, the staff finds the applicant's response to RAI 4.7.5-3 acceptable because the applicant has verified that the program adequately manages aging effects that are identified, which satisfies the criterion defined in SRP-LR Section A.1.2.3.10. Therefore, the staff's concern described in RAI 4.7.5-3 is resolved.

The staff confirms that the applicant's "operating experience" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.10. On this basis, the staff finds the applicant's "operating experience" effects of the program acceptable.

UFSAR Supplement. The applicant provided the UFSAR supplement for the Settlement Monitoring Program in LRA Section A.1.37. The staff reviewed this Section and finds the UFSAR supplement information an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. Based on its review of the applicant's Settlement Monitoring Program (Unit 2 only), the staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the

UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.6 Selective Leaching of Materials Inspection Program

Summary of Technical Information in the LRA. Section B.2.36 of LRA Appendix B described the Selective Leaching of Materials Program. By letter dated September 5, 2008, the applicant replaced the Selective Leaching Inspection Program with a plant-specific Selective Leaching of Materials Inspection Program. The applicant determined during the review of operating experience that buried gray cast iron fire protection piping has experienced selective leaching. The applicant stated that for this piping, there will be periodic inspections to insure that selective leaching is identified before a loss of component intended function. The program will continue to consist of a one-time visual inspection and hardness examination of selected components that are susceptible to selective leaching. The applicant stated that the program scope includes components and commodities (for example, piping, pump casings, valve bodies and heat exchanger components) made of copper alloys with zinc content greater than 15%. Gray cast iron which is exposed to a raw water, treated water, air, condensation, or soil environment will be periodically inspected. Should evidence of significant selective leaching be revealed by the one-time inspection or previous operating experience, the Corrective Action Program will be used for the unacceptable inspection findings. The resolution will include evaluation for expansion of the inspection sample size, locations, and frequency.

Staff Evaluation. The staff reviewed the Selective Leaching of Material Inspection Program against the AMP elements found in the GALL Report, in SRP-LR Section A.1.2.3, and in SRP-Table A.1-1, focusing on how the program manages aging effects through the effective incorporation of 10 program elements. The staff's evaluations of the "scope of program," "preventative actions," "parameters monitored/inspected," "detecting of aging effects," "monitoring and trending," "acceptance criteria," and "operating experience," program elements for this AMP are given in the subsections that follow. The staff reviewed the AMP's "corrective actions," administrative controls," and "confirmation process" program elements as part of its review of LRA AMP B.1.3, "Quality Assurance Program and Administrative Controls." The staff's evaluation of the "corrective actions," administrative controls," and "confirmation process" program elements is given in SER Section 3.0.4.

Scope of Program. LRA Section B.2.36 as supplemented by the letter dated September 25, 2008, states that the scope of the program will include all components and commodities identified in AMRs as susceptible to loss of material due to selective leaching. The scope includes components and commodities (for example, piping, pump casings, valve bodies and heat exchanger components) made of gray cast iron and copper alloys with zinc content greater than 15 percent that are exposed to raw water, treated water, air, condensation, or soil.

The applicant further states in the September 25, 2008 letter that a representative sample of components that are susceptible to selective leaching will be selected for examination. For components that are not part of the gray cast iron fire protection piping, the sample will be selected using EPRI guidance developed for an earlier utility. The sample population for buried gray cast iron fire protection piping will be based on test equipment limitations, piping configuration, and plant operating experience.

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 structures and components of which the program manages the aging."

The staff noted that the program specifies that it manages loss of material in components made of cast iron or copper alloys containing greater than 15% zinc as an alloying element. The staff found this to be acceptable because it is consistent with the AMRs in Sections VII and VIII on the components materials that may be susceptible to selective leaching. The staff also noted that this program was designated for management of aluminum bronze components, which according to the GALL Report, may also be susceptible to the phenomenon of selecting leaching. The staff confirmed that the applicant's plant design does not include any in-scope, passive long-lived components that are made of aluminum bronze materials. Thus, based on this confirmation, the staff finds that the program does not need to be credited for the management of aluminum bronze components because the LRA does not include any aluminum bronze components that need to be scoped and screened in for an aging management review.

The staff confirmed that the "scope of program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

<u>Preventive Actions</u>. LRA Section B.2.36 states as supplemented by the letter dated September 25, 2008, that the program is an evaluation and inspection program with no preventive actions to preclude or mitigate aging effects.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2-2 which states:

> "For condition or performance monitoring programs, they do not rely on preventive actions and thus, this information need not be provided."

The staff noted that this is a condition monitoring program that does not include any preventive actions to preclude or mitigate aging effects.

The staff confirmed that the "preventive actions" program element does not need to meet the criterion defined in SRP-LR Section A.1.2.3.2 because the Selective Leaching of Materials Inspection Program is a condition monitoring program that does not include any preventative or mitigative controls.

<u>Parameters Monitored or Inspected</u>. LRA Section B.2.36 states as supplemented by the letter dated September 25, 2008, that for buried gray cast iron fire protection piping, the program will consist of periodic testing of a sample population using methods capable of determining locations where coating degradation has occurred and where selective leaching could be occurring. For the remaining components within the scope of this program, visual inspections combined with qualitative hardness examinations of internal surfaces will be performed. These examinations will be used to determine if selective leaching has occurred and the extent that any selective leaching will affect the component's intended function.

The staff reviewed the applicant's "parameters monitored/inspected" program element against the criteria in SRP-LR Section A.1.2.3.3-2 which states:

> "For a condition monitoring program, the parameter monitored or inspected should detect the presence and extent of aging effects. Some examples are measurements of wall thickness and detection and sizing of cracks."

The staff noted that the intended function for components susceptible to selective leaching is to serve as a pressure boundary. Selective leaching is a process that can leach one or more element or secondary phase from the microstructure of metallic alloys (cast iron, copper alloys containing greater than 15% zinc as an alloying element and aluminum bronzes containing greater than 8% aluminum as an alloying element) that are susceptible to this aging mechanism. This process can induce porosity on the components over time, which significantly reduces the fracture toughness of the component materials and even lead to leakage because the porosity becomes interlinked and develops throughwall. The staff noted that the applicant's Selective Leaching Inspection Program is credited to monitor for loss of material as a result of selective leaching and will provide visual examinations and hardness tests to determine if porosity induced by selective leaching has led to loss of material in any of these components. Based on this review, the staff finds that the applicant's "parameters monitored/inspected" program element satisfies the corresponding program element criterion in SRP-LR Section A.1.2.3.3 because the applicant has identified the aging effect that the program monitors for and because the applicant has identified the parameters monitored that will be indicative of the aging effect of concern.

The staff confirmed that the "parameters monitored/inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

<u>Detection of Aging Effects</u>. LRA Section B.2.36 states as supplemented by the letter dated September 25, 2008, that for buried gray cast iron fire protection piping, the program will consist of periodic testing of a sample population using methods capable of determining locations of piping or where coating degradation has occurred and where selective leaching could be occurring. The applicant stated that the testing will be performed prior to entering the period of extended operation and periodically after that. The applicant also stated that the frequency of testing will be established during the initial inspection, but will not exceed 10 years.

For the remaining components within the scope of this program, visual inspections combined with qualitative hardness examinations of internal surfaces will be performed. These examinations will be used to determine if selective leaching has occurred and the extent that any selective leaching will affect the component's intended function. The applicant stated that groups of components with the same material-environment combination will be considered as a separate population and each group of components will be treated separately. Each group of components will be visually examined and the internal surfaces of these components will be scrapped or chipped to determine if selective leaching is occurring.

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:

> "Detection of aging effects should occur before there is a loss of the structure and component intended function(s). The parameters to be monitored or

inspected should be appropriate to ensure that the structure and component intended function(s) will be adequately maintained for license renewal under all CLB design conditions. This includes aspects such as method or technique (e.g., visual, volumetric, surface inspection), frequency, sample size, data collection and timing of new/one-time inspections to ensure timely detection of aging effects. Provide information that links the parameters to be monitored or inspected to the aging effects being managed."

"Nuclear power plants are licensed based on redundancy, diversity, and defense-in-depth principles. A degraded or failed component reduces the reliability of the system, challenges safety systems, and contributes to plant risk. Thus, the effects of aging on a structure or component should be managed to ensure its availability to perform its intended function(s) as designed when called upon. In this way, all system level intended function(s), including redundancy, diversity, and defense-in-depth consistent with the plant's CLB, would be maintained for license renewal. A program based solely on detecting structure and component failure should not be considered as an effective aging management program for license renewal."

"This program element describes "when," "where," and "how" program data are collected (i.e., all aspects of activities to collect data as part of the program)."

"The method or technique and frequency may be linked to plant-specific or industry-wide operating experience. Provide justification, including codes and standards referenced, that the technique and frequency are adequate to detect the aging effects before a loss of SC intended function. A program based solely on detecting SC failures is not considered an effective aging management program."

"When sampling is used to inspect a group of SCs, provide the basis for the inspection population and sample size. The inspection population should be based on such aspects of the SCs as a similarity of materials of construction, fabrication, procurement, design, installation, operating environment, or aging effects. The sample size should be based on such aspects of the SCs as the specific aging effect, location, existing technical information, system and structure design, materials of construction, service environment, or previous failure history. The samples should be biased toward locations most susceptible to the specific aging effect of concern in the period of extended operation. Provisions should also be included on expanding the sample size when degradation is detected in the initial sample."

The staff's review found the one-time inspection of the components that are not part of the fire protection system is appropriate to insure there will not be a loss of intended function because the applicant does not yet have any operating experience that indicates that selective leaching has occurred in these non-fire protection system components. Thus, for these non-fire protection system components, the staff found this to be acceptable in meeting the staff's recommendation in SRP-LR Section A.1.2.3.4 because, although the one-time inspection program that does not have a periodic re-inspection frequency, the inspection will be sufficient to confirm that loss of material due to selective leaching is not occurring in the components or else to prompt the applicant to take appropriate corrective actions under the program's "corrective actions" program element if it is confirmed that selective leaching is occurring in these components. Thus, the staff finds that the one-time inspection for the non-fire protection system components meets the staff's criterion in SRP-LR Section A.1.2.3.4 because the program does not rely on waiting for a component failure to occur as an aging management basis for the AMP.

The staff also noted that the frequency of the examinations for the fire protection components is linked to Beaver Valley plant-specific operating experience because selective leaching has been previously identified in the plant's fire protection piping. Thus, the staff noted that the periodic inspections of the fire protection piping components is appropriate because the applicant has actually experienced and detected selective leaching specific fire protection piping components in the past. The staff noted that the re-inspection frequency for these fire protection piping components will be based on a review of the operating experience and past inspection results of these components, but not to exceed a re-inspection frequency of once every 10 years. The staff also finds this to be acceptable because the re-inspection frequency will be based on actual plant operating experience to preclude component failures, but will not be more than the re-inspection frequency equivalent to the 10-year inspection frequency established in the applicant's 10-Year Inservice Inspection Plan.

The staff noted that the program's selective leaching technique includes both visual examination methods and qualitative hardness tests of the material. The staff finds this to be appropriate because any porosity that is induced by selective leaching is a large-scale effect that can be noticed by visual examinations and because a drop in the component hardness properties, as monitored for by the hardness tests, may indirectly be indicative of a drop in the fracture toughness in the component materials. Thus, the staff finds that the visual examinations and hardness tests of the components materials are acceptable methods for identifying selective leaching in cast iron and copper alloys containing greater the 15% zinc.

The staff also noted that the applicant has an appropriate sampling basis for the inspections and hardness tests because they are using an EPRI developed sampling plan that has been found acceptable by the staff and because the applicant will apply the results of its visual inspections and hardness tests as a commodity group basis for evaluating same-kind components that are not scheduled for inspection and hardness testing under this program (i.e., as a commodity group basis for evaluating the uninspected/untested components that are made of the same material and are subject to the same environmental conditions as the components that have been inspected and tested). The staff also finds this to be acceptable because the applicant takes into account previous relevant operating experience in establishing the frequencies and sample sizes of the program's visual inspections and hardness tests.

Thus, based on this review, the staff finds that the applicant has met the staff's criterion in SRP-LR Section A.1.2.3.4 because the applicant has defined the inspection and testing techniques, frequencies and sample sizes that will be implemented in accordance with this AMP. The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.4 and that this program element is acceptable.

Monitoring and Trending. LRA Section B.2.36 states as supplemented by the letter dated September 25, 2008, that monitoring and trending does not apply to the components other than the fire protection piping because it is a one-time inspection. For the buried fire protection piping, the results of the initial test will be used to determine the frequency for the period of extended operation. The period between inspections will not exceed 10 years. The results of the tests will be documented and retained in a retrievable form.

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:

> "Monitoring and trending activities should be described, and they should provide predictability of the extent of degradation and thus effect timely corrective or meditative actions. Plant-specific and/or industry-wide operating experience may be considered in evaluating the appropriateness of the technique and frequency."

The staff review finds that for components other than the buried fire protection piping, there will not be any monitoring and trending because it is a one-time inspection. For the buried fire protection piping, the staff review finds this program element acceptable because the applicant will conduct periodic inspections based on consideration of the plant-specific operating experience. The inspection results will be monitored and trended to reestablish the frequency of examinations of the fire protection system piping. Thus, based on this review, the staff finds that for the fire protection system components, the applicant has met the staff's recommendation in SRP-LR Section A.1.2.3.5 because the program will trend the inspection results for the cast iron components and copper with greater than 15% zinc components that are within the scope of the fire protection system.

Thus, based on this review, the staff confirmed that, for the fire protection system components, the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5 and that the program element is acceptable. Based on this review, the staff finds that the program does not need to satisfy the criterion in SRP-LR Section A.1.2.3.5 for the non-fire protection system components because the program calls for a one-time inspection of the components.

<u>Acceptance Criteria</u>. LRA Section B.2.36 states as supplemented by the letter dated September 25, 2008, that any indications of degradation by selective leaching will be addressed using the corrective action program.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.5 which states:

> "Qualitative inspections should be performed to some predetermined criteria as quantitative inspections by personnel in accordance with ASME Code and through approved site specific programs."

The staff review finds that the applicant's acceptance criteria program element is acceptable because any degradation that is detected as a result of the program's visual examinations or indirectly observed as a result of the program's hardness tests will be evaluated using the corrective action program.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

Operating Experience. The staff also reviewed operating experience and selected condition reports and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. In the application, the applicant stated that there is no operating experience for the effectiveness of the program because it is a new program.

The applicant stated that during the review of operating experience, the applicant identified selective leaching for buried gray cast iron fire protection piping. As a result of this observation, the applicant stated that they will conduct periodic inspections of the buried gray cast iron fire protection piping. In 2001, the applicant stated that the fire pump auto-started, and water was observed coming from the ground due to the selective leaching of the buried gray cast iron fire protection piping. A failure analysis was conducted and the presence of selective leaching was verified. The applicant stated that the failure was attributed to the failure of the bituminous coating on the piping. The piping was replaced using a material that is not susceptible to selective leaching.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable because the applicant has demonstrated that it takes appropriate plant operating experience into account in establishing the program elements for this AMP.

UFSAR Supplement. In LRA Section A.1.36, the applicant provided the UFSAR Supplement for the Selective Leaching of Materials Inspection Program. The staff reviewed this UFSAR Supplement for adequacy. The staff found that, although the UFSAR Supplement was different from the staff's recommended UFSAR supplement for these type of AMPs in SRP-LR Table 3.3-2, the applicant's UFSAR Supplement description for the AMP was adequate because it provided a summary of the components that the program monitors, the inspection and hardness techniques that the program will implement to monitor for selective leaching of the components, and the corrective actions that will be taken if selective leaching is detected in the components.

The staff also noted that the applicant's UFSAR Supplement for the Selective Leaching of Materials Inspection Program includes LRA Commitment No. 19 in UFSAR Supplement Table A4-1 for Unit 1 and LRA Commitment No. 21 in UFSAR Supplement Table A5-1 for Unit 1. The staff noted that in these commitments the applicant committed to implementing the Selective Leaching of Materials Inspection Program by July 29, 2016 for Unit 1 and by May 27, 2027 for Unit 2. The staff finds this to be an appropriate LRA commitment for this AMP because the applicant's Selective Leaching of Materials Inspection Program is designated as a new program for the application that has yet to be implemented for license renewal and because, under these commitments, the implementation of the one-time inspections that is credited under this program for the units will be implemented prior to entering the period of extended operation.

Based on this review, the staff finds that the applicant's UFSAR supplement for the Selective Leaching of Materials Inspection Program provides an adequate summary description of the program, as required by 10 CFR 54.21(d) because the applicant has provided sufficient details on how the program will be implemented in the summary description and because the UFSAR Supplement includes appropriate commitments to implement this new program during the period of extended operation.

Conclusion. The staff finds the applicant's Selective Leaching of Materials Inspection Program is acceptable because the staff has confirmed that the program elements for the AMP are in conformance with the staff's program element criteria that are defined in SRP-LR Section A.1.2.3.

On the basis of its technical review of the applicant's Selective Leaching Inspection Program as discussed above, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.7 Boral® Surveillance Program

Summary of Technical Information in the Application. In Amendment 34, dated January 19, 2009, the applicant made a revision of the LRA to include LRA Section A.1.43, Boral® Surveillance Program (Unit 1 Only). In this section of the LRA the applicant provided the following program description:

> The Boral® Surveillance Program is an existing plant-specific condition monitoring program for which there is no comparable NUREG01801 aging management program. The program manages the neutron absorbing function of the BVPS Unit 1 High Density Spent Fuel Storage racks by the removal and testing of sample Boral® neutron absorber coupons. Coupon analysis is performed by a vendor, and recommendations based on the analysis are provided to FENOC.
>
> The purpose of the program is to characterize certain properties of the Boral® in the storage racks to assure its capability to fulfill its intended function, and to assure that assumptions made in the Fuel Pool criticality analysis remain valid. Because the test coupons are located and configured to ensure exposure to higher-than average levels of gamma radiation, data gathered by the program represent accelerated use, and there is reasonable assurance that degradation will be detected and corrective actions taken prior to a loss of intended function.

Staff Evaluation. The staff reviewed the Boral® Surveillance Program in LRA Section B.2.43 (in Amendment 34) against the AMP elements found in the SRP-LR Section A.1.2.3, and in SRP-LR Table A.1-1, focusing on how the program manages aging effects through the effective incorporation of 10 elements. Specifically, the staff reviewed the following seven (7) program elements of the applicant's program: (1) "scope of the program," (2) "preventive actions," (3) "parameters monitored or inspected," (4) "detection of aging effects," (5) "monitoring and trending," (6) " acceptance criteria," and (10) "operating experience."

In LRA Section B.2.43, the applicant provided the following elements: (7) corrective actions, (8) confirmation process, and (9) administrative controls common to all AMPs. The applicant indicated that program elements (7) "corrective actions," (8) "confirmation process," and (9) "administrative controls" are parts of the site-controlled QA program. The staff's evaluation of the QA program is in SER Section 3.0.4. Evaluation of the remaining seven elements follows:

Scope of the Program. LRA Section B.2.43 states that, “The scope of the program consists of the Boral® neutron absorbing material in the High Density Spent Fuel Storage Racks at BVPS Unit 1. The program applies only to BVPS Unit 1, because the BVPS Unit 2 Spent Fuel Storage Racks do not use Boral® as a neutron absorber.”

The staff confirms that the “scope of the program” program element satisfies the guidance in SRP-LR Section A.1.2.3.1, since the staff confirmed that Boral® was only used in BVPS Unit 1 spent fuel pool and BVPS Unit 2 uses Boraflex. Therefore, the staff finds this program element acceptable.

Preventive Actions. LRA Section B.2.43 states that, “The program is a condition monitoring program that does not contain preventive actions.”

The staff confirms that the “preventive actions” program element satisfies the guidance in SRP-LR Section A.1.2.3.2 since BVPS Unit 1 has a condition monitoring program. Therefore, the staff finds this program element acceptable.

Parameters Monitored or Inspected. LRA Section B.2.43 states that, “The program monitors changes in physical properties of the Boral® by performing measurements on representative Boral® coupons. The coupons simulate as nearly as possible the actual in-service geometry, physical mounting, materials, and flow conditions of the Boral® panels in the storage racks. The coupons are removed in accordance with a prescribed schedule. Upon removal, each coupon is inspected and tested to determine changes in physical properties of the Boral® in the spent fuel pool. The measurements performed are:

- Visual Observation and Photography
- Neutron Attenuation
- Dimensional Measurements (length, width, and thickness)
- Weight and Specific Gravity

The program provides for additional, optional measurement parameters and actions, including radiography, destructive wet chemical analysis, re-insertion of tested coupons, and in-service inspection of the Boral® panels themselves. These additional actions provide options for confirming or further investigating results of coupon analysis”

The staff confirms that the “parameters monitored or inspected” program element satisfies the guidance in SRP-LR Section A.1.2.3.3. The staff considers this program element acceptable because experience has shown that Boral® degradation in the SFP environment occurs slowly and can be detected in the early stages by the methods proposed. The measurements of neutron attenuation, physical distortion, and weight change would detect coupon degradation that would precede a loss of functionality in the Boral® panels (neutron absorption and fuel assembly spacing). Moreover, unacceptable coupon results would initiate an engineering evaluation and, if considered necessary, direct testing of the storage racks (i.e. blackness testing).

Detection of Aging Effects. LRA Section B.2.43 states that “The program was approved by the NRC in the "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 178 to Facility Operating License No. DPR - 66". Detection of aging effects occurs through monitoring changes in physical properties of the Boral® coupons. When the program was initiated, a total of 20 test coupons were installed in the Unit I fuel pool, with 10 coupons installed in each of 2 coupon trees. Coupons are removed for analysis according to a prescribed schedule. The schedule is such that coupons will be removed through the period of extended operation.

After removal, three length measurements and three width measurements are taken and compared to corresponding pre-irradiation measurements. Five thickness measurements are taken and compared to corresponding pre-irradiation measurements. The coupons are examined visually for signs of degradation, including edge and comer defects, discoloration, and surface pitting.

The coupons are then dried carefully in three stages to avoid expansion of the water which has been absorbed and subsequent bulging of the coupon.

Neutron attenuation measurements are made relative to a standard sample. Weight and specific gravity measurements are also taken."

The staff confirms that the "detection of aging effects" program element satisfies the guidance in SRP-LR Section A.1.2.3.4 since the staff considers the program to collect data from representative coupon samples to assess for stability and integrity of Boral® to be acceptable for detection of aging effects. Therefore, the staff finds this program element acceptable.

Monitoring and Trending. LRA Section B.2.43 states that "The evaluation of the coupons provides information on the radiological effects, thermal effects, and chemical effects of the spent fuel pool environment on the Boral® panels. For the first several refueling cycles after installation, the coupon trees are surrounded by discharged fuel assemblies having a high specific power prior to shutdown. This fuel storage configuration is intended to accelerate aging of the test coupons. Over the duration of the coupon testing program, the coupons will have accumulated more radiation dose than the expected lifetime dose for normal storage cells.

Because the test coupon data gathered by the program represents accelerated use, there is reasonable assurance that degradation will be detected and corrective actions taken prior to a loss of intended function of the Boral® panels themselves."

The staff confirms that the "monitoring and trending" program element satisfies the guidance in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable because the applicant monitors and trends parameters that would indicate degradation prior to a loss of intended function of the Boral® panels.

<u>Acceptance Criteria</u>. LRA Section B.2.43 states that "The most significant measurements taken are thickness (to monitor for swelling) and neutron attenuation (to confirm the concentration of Boron-10 in the Boral®). Acceptance criteria for these measurements are as follows:

- A decrease of no more than 5% in Boron-10 content as determined by neutron attenuation.
- An increase in thickness at any point should not exceed 10% of the initial thickness at that point.

Changes in excess of either of these two criteria require investigation and engineering evaluation to identify whether further testing or corrective actions may be necessary.

The remaining measurement parameters serve a supporting role and should be examined for early indications of the potential onset of Boral® degradation that would suggest a need for further attention. These include:

- Visual or photographic evidence of unusual surface pitting, corrosion or edge deterioration
- Unaccountable weight loss in excess of the measurement accuracy
- The existence of areas of reduced boron density should an optional neutron radiograph be taken”

The staff confirms that the “acceptance criteria” program element satisfies the guidance in SRP-LR Section A.1.2.3.6 since BVPS Unit 1 provided specific values for the acceptance criteria which would provide reasonable assurance that corrective actions could be taken before loss of functionality would occur. The staff finds this program element acceptable.

Operating Experience. LRA Section B.2.34 states that “The program administers the removal and testing of sample Boral® neutron absorber coupons. Coupon analysis is performed by a vendor, and recommendations based on the analysis are provided to FENOC. The results of Boral® coupon analysis are recorded in inspection reports. Recommended items for evaluation from the reports have been documented in the BVPS Corrective Action Program.

To date, the most recent program inspection report was issued in 2007. Two coupons were removed from the BVPS Unit 1 Spent Fuel Pool in June 2007 and shipped to Northeast Technology Corp (NETCO) for testing. The results of these tests are indicative of satisfactory material performance. However, both coupons had numerous blisters in the Boral® cladding. The previous inspection report, issued in 2002, identified a few small blisters on the coupons. Prior to that, no blisters were noted on the coupons. Because the blisters displace water from the flux trap of the Region I racks, they could potentially challenge dimensional assumptions made in the fuel pool criticality analysis. FENOC performed an evaluation of the blisters through the Corrective Action Program. FENOC will monitor future surveillance coupons for extent and progression of corrosion and blister growth. This action is consistent with recommendations from NETCO and EPRI Report 1013721, "Handbook of Neutron Absorber Materials for Spent Nuclear Fuel Transportation and Storage Applications."

Although the results of the coupon analysis warranted further evaluation, the neutron attenuation and structural integrity of the coupons was determined to be unaffected. The operating experience for the program provides evidence that continued surveillance of the coupons will effectively manage aging effects such that there is no loss of intended function.”

The staff confirms that the “operating experience” program element satisfies the guidance in SRP-LR Section A.1.2.3.10, since the operating experience supports the conclusion that the Boral® Surveillance Program will be able to effectively manage the loss of neutron-absorbing capacity and degradation of Boral®. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.1.43, the applicant provided the most recent UFSAR Supplement for the Boral® Surveillance Program (Unit 1 Only), which was provided as an amendment of the LRA in the letter of January 19, 2009. The staff reviewed this UFSAR Supplement for adequacy. The staff found that the summary description of the Boral® Surveillance Program would provide adequate assurance that the assumptions made in the Fuel Pool criticality analysis would remain valid for the period of extended operation. The program would have coupons removed and analyzed by a vendor, who would make recommendations based on the analysis. These test coupons are exposed to higher-than-average levels of gamma radiation and any data from these coupons would represent accelerated exposure. The staff finds the summary acceptable since there is adequate assurance that degradation will be detected and corrective actions taken prior to the loss of intended function. Therefore, the staff concludes that the UFSAR supplement for this AMP 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 Boral® Surveillance Program, the staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 QA Program Attributes Integral to Aging Management Programs

In LRA Sections A.1, "Summary Description of Aging Management Programs" and B.1.3, "Quality Assurance Program and Administrative Controls," the applicant described the elements of corrective action, confirmation process, and administrative controls applied to the AMPs for both safety-related and nonsafety-related components. The BVPS Quality Assurance (QA) program, described in Unit 1 UFSAR Appendix A, and Unit 2 UFSAR, Chapter 17, implements the requirements of 10 CFR Part 50, Appendix B. The Corrective Action Program applies corrective actions, confirmation, and administrative controls regardless of component safety classification. Specifically, LRA Section B.1.3 states that the QA program implements the requirements of 10 CFR Part 50, Appendix B. LRA Section B.2, "Aging Management Programs," summarizes the AMPs.

3.0.4.1 Summary of Technical Information in the Application

Sections A.1, "Summary Description of Aging Management Programs," and B.1.3, "Quality Assurance Program and Administrative Controls," of the license renewal application (LRA), described the elements of corrective action, confirmation process, and administrative controls that are applied to the aging management programs (AMPs) for both safety-related (SR) and nonsafety-related components. The BVPS quality assurance program (QAP), which includes the elements of corrective action, confirmation process, and administrative controls, is to the QA attributes regardless of the safety classification of the components. Specifically, in Section A.1 and Section B.1.3 the applicant stated that the QA Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with NUREG-1801, "Generic Aging Lessons Learned (GALL) Report."

3.0.4.2 Staff Evaluation

Pursuant to 10 CFR 54.21(a)(3), an applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation. NUREG-1800, Branch Technical Position RLSB-1, "Aging Management Review - Generic," describes ten attributes of an acceptable AMP. Three of these ten attributes are associated with the QA activities of corrective action, confirmation process, and administrative controls. Table A.1-1, "Elements of an Aging Management Program for license Renewal," of Branch Technical Position RLSB-1 provides the following description of these quality attributes:

- Attribute No. 7 - Corrective Actions, including root cause determination and prevention of recurrence, should be timely;
- Attribute No. 8 - Confirmation Process, which should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective; and,
- Attribute No. 9 - Administrative Controls, which should provide a formal review and approval process.

NUREG-1800, Branch Technical Position IQMB-1 noted that those aspects of the AMP that affect quality of safety-related SSCs are subject to the QA requirements of Appendix B to 10 CFR Part 50. Additionally, for nonsafety-related SCs subject to an AMR, the applicant's existing Appendix B to 10 CFR Part 50 QA program may be used to address the elements of corrective action, confirmation process, and administrative control. Branch Technical Position IQMB-1 provides the following guidance with regard to the QA attributes of AMPs:

> "Safety-related SCs are subject to Appendix B to 10 CFR Part 50 requirements which are adequate to address all quality related aspects of an AMP consistent with the CLB of the facility for the period of extended operation. For nonsafety-related SCs that are subject to an AMR for license renewal, an applicant has an option to expand the scope of its Appendix B to 10 CFR Part 50 program to include these SCs to address corrective action, confirmation process, and administrative control for aging management during the period of extended operation. In this case, the applicant should document such a commitment in the Final Safety Analysis Report supplement in accordance with 10 CFR 54.21(d)."

The NRC staff reviewed the applicant's aging management programs (AMPs) described in Appendix A, "Updated Final Safety Analysis Report Supplement," and Appendix B, "Aging Management Programs and Activities," of the LRA, and the associated implementing documents. The purpose of this review was to ensure that the quality assurance attributes (corrective action, confirmation process, and administrative controls) were consistent with the staff's guidance described in NUREG-1800, Section A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)." Based on the NRC 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 quality assurance for aging management.

3.0.4.3 Conclusion

On the basis of the NRC 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)

3.1 Aging Management of Reactor Vessel, Reactor Vessel Internals, and Reactor Coolant System

This Section of the SER documents the staff's review of the applicant's AMR results for the reactor vessel, reactor vessel internals, and RCS components and component groups of:

- reactor vessel
- reactor vessel internals
- RCS

3.1.1 Summary of Technical Information in the Application

LRA Section 3.1 provides AMR results for the reactor vessel, reactor vessel internals, and RCS components and component groups. LRA Table 3.1.1, "Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for the Reactor Vessel, Reactor Vessel Internals, and Reactor Coolant System," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the reactor vessel, reactor vessel internals, and RCS components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs.
The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.1.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the reactor vessel, reactor vessel internals, and RCS components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of 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 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 3.1.2.1.

In the onsite audit, the staff also 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 3.1.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.1.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.1.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.1-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.1 and addressed in the GALL Report.

Table 3.1-1 Staff Evaluation for Reactor Vessel, Reactor Vessel Internals, and Reactor Coolant System Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel pressure vessel support skirt and attachment welds (3.1.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds (3.1.1-2)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to PWRs (See 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 reactor coolant pressure boundary piping, piping components, and piping elements exposed to reactor coolant (3.1.1-3)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	Not applicable	Not applicable to PWRs (See 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 7000 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 reactor vessel internals components (3.1.1-5)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
nickel-alloy tubes and sleeves in a reactor coolant and secondary feedwater/steam environment (3.1.1-6)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel and stainless steel reactor coolant pressure boundary closure bolting, head closure studs, support skirts and attachment welds, pressurizer relief tank components, steam generator components, piping and components external surfaces and bolting (3.1.1-7)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)

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-alloy reactor coolant pressure boundary piping, piping components, piping elements; flanges; nozzles and safe ends; pressurizer vessel shell heads and welds; heater sheaths and sleeves; penetrations; and thermal sleeves (3.1.1-8)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor vessel components: flanges; nozzles; penetrations; pressure housings; safe ends; thermal sleeves; vessel shells, heads and welds (3.1.1-9)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy steam generator components (flanges; penetrations; nozzles; safe ends, lower heads and welds) (3.1.1-10)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.1.2.2.1)
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)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel steam generator 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	Not applicable	Not applicable to BVPS (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)
Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds (3.1.1-14)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.2)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-15)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.2)
Steel steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam (3.1.1-16)	Loss of material due to general, pitting and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry and, for Westinghouse Model 44 and 51 S/G, if general and pitting corrosion of the shell is known to exist, additional inspection procedures are to be developed.	Yes	ASME Code Section XI Inservice Inspection, Subsection IWB, IWC, and IWD for Class 2 components (B.2.2) and Water Chemistry (B.2.42)	Consistent with the GALL Report (See SER Section 3.1.2.2.2.4)

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
Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds (3.1.1-17)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with 10 CFR 50, Appendix G, and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations.	Yes	TLAA	Loss of fracture toughness is a TLAA (See SER Section 3.1.2.2.3 item (1))
Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles (3.1.1-18)	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor Vessel Surveillance	Yes	Reactor Vessel Integrity (B.2.35)	Consistent with the GALL Report (See SER Section 3.1.2.2.3 item (2))
Stainless steel and nickel-alloy top head enclosure vessel flange leak detection line (3.1.1-19)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.4)
Stainless steel isolation condenser components exposed to reactor coolant (3.1.1-20)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and plant-specific verification program	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.4)
Reactor vessel shell fabricated of SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process (3.1.1-21)	Crack growth due to cyclic loading	TLAA	Yes	TLAA	Crack growth due to cyclic loading is a TLAA (See SER Section 3.1.2.2.5)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel-alloy reactor vessel internals components exposed to reactor coolant and neutron flux (3.1.1-22)	Loss of fracture toughness due to neutron irradiation embrittlement, void swelling	FSAR supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	Yes	PWR Vessel Internals Program Commitment (B.2.33)	Consistent with the GALL Report (See SER Section 3.1.2.2.6)
Stainless steel reactor vessel closure head flange leak detection line and bottom-mounted instrument guide tubes (3.1.1-23)	Cracking due to stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes	Water Chemistry (B.2.42) and One Time Inspection (B.2.30)	Consistent with the GALL Report (See SER Section 3.1.2.2.7.1)
Class 1 cast austenitic stainless steel piping, piping components, and piping elements exposed to reactor coolant (3.1.1-24)	Cracking due to stress corrosion cracking	Water Chemistry and, for CASS components that do not meet the NUREG-0313 guidelines, a plant-specific AMP	Yes	Water Chemistry (B.2.42) and ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD (B.2.2)	Consistent with the GALL Report (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 aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.8)
Steel and stainless steel isolation condenser components exposed to reactor coolant (3.1.1-26)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD) and plant-specific verification program	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.8)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel-alloy reactor vessel internals screws, bolts, tie rods, and hold-down springs (3.1.1-27)	Loss of preload due to stress relaxation	FSAR supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	Yes	PWR Vessel Internals (B.2.33) Commitments	Consistent with the GALL Report (See SER Section 3.1.2.2.9)
Steel steam generator feedwater impingement plate and support exposed to secondary feedwater (3.1.1-28)	Loss of material due to erosion	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.2.10)
Stainless steel steam dryers exposed to reactor coolant (3.1.1-29)	Cracking due to flow-induced vibration	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.1.2.2.11)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel reactor vessel internals components (e.g., Upper internals assembly, RCCA guide tube assemblies, Baffle/former assembly, Lower internal assembly, shroud assemblies, Plenum cover and plenum cylinder, Upper grid assembly, Control rod guide tube (CRGT) assembly, Core support shield assembly, Core barrel assembly, Lower grid assembly, Flow distributor assembly, Thermal shield, Instrumentation support structures) (3.1.1-30)	Cracking due to stress corrosion cracking, irradiation-assisted stress corrosion cracking	Water Chemistry and FSAR supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	Yes	Water Chemistry (B.2.42) and PWR Vessel Internals Program (B.2.33) Commitments	Consistent with the GALL Report (See SER Section 3.1.2.2.12)
Nickel-alloy and steel with nickel-alloy cladding piping, piping component, piping elements, penetrations, nozzles, safe ends, and welds (other than reactor vessel head); pressurizer heater sheaths, sleeves, diaphragm plate, manways and flanges; core support pads/core guide lugs (3.1.1-31)	Cracking due to primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and FSAR supplement commitment to implement applicable plant commitments to (1) NRC Orders, Bulletins, and Generic Letters associated with nickel-alloys and (2) staff-accepted industry guidelines.	Yes	Water Chemistry (B.2.42) and ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD (B.2.2) Nickel-Alloy Nozzles and Penetrations Program (B.2.28) Commitment	Consistent with the GALL Report (See SER Section 3.1.2.2.13)
Steel steam generator feedwater inlet ring and supports (3.1.1-32)	Wall thinning due to flow-accelerated corrosion	A plant-specific aging management program is to be evaluated.	Yes	One-Time Inspection (B.2.30)	Consistent with the GALL Report (See SER Section 3.1.2.2.14)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and nickel-alloy reactor vessel internals components (3.1.1-33)	Changes in dimensions due to void swelling	FSAR supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	Yes	PWR Vessel Internals Program (B.2.33) Commitment	Consistent with the GALL Report (See SER Section 3.1.2.2.15)
Stainless steel and nickel-alloy reactor control rod drive head penetration pressure housings (3.1.1-34)	Cracking due to stress corrosion cracking and primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and for nickel-alloy, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	Yes	Water Chemistry (B.2.42) and ASME Section XI Inservice Section, Subsections IWB, IWC, and IWD (B.2.2) Nickel-Alloy Nozzles and Penetrations Program (B.2.28) Commitment	Consistent with the GALL Report (See SER Section 3.1.2.2.16. 1)
Steel with stainless steel or nickel-alloy cladding primary side components; steam generator upper and lower heads, tubesheets and tube-to-tube sheet welds (3.1.1-35)	Cracking due to stress corrosion cracking and primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and for nickel-alloy, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	Yes	Not applicable	Not applicable to BVPS (See SER Sections 3.1.2.1.1 and 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 stress corrosion cracking and primary water stress corrosion cracking	Water Chemistry and One-Time Inspection and, for nickel-alloy welded spray heads, comply with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines.	Yes	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See SER Section 3.1.2.2.16.2)
Stainless steel and nickel-alloy reactor vessel internals components (e.g., Upper internals assembly, RCCA guide tube assemblies, Lower internal assembly, CEA shroud assemblies, Core shroud assembly, Core support shield assembly, Core barrel assembly, Lower grid assembly, Flow distributor assembly) (3.1.1-37)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking, irradiation-assisted stress corrosion cracking	Water Chemistry and FSAR supplement commitment to (1) participate in industry RVI aging programs (2) implement applicable results (3) submit for NRC approval > 24 months before the extended period an RVI inspection plan based on industry recommendation.	Yes	Water Chemistry (B.2.42) PWR Vessel Internals (B.2.33) Commitment	Consistent with the GALL Report (See SER Section 3.1.2.2.17)
Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant (3.1.1-38)	Cracking due to cyclic loading	BWR Control Rod Drive Return Line Nozzle	No	Not applicable	Not applicable to PWRs
Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant (3.1.1-39)	Cracking due to cyclic loading	BWR Feedwater Nozzle	No	Not applicable	Not applicable to PWRs

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 control rod drive stub tubes instrumentation, jet pump instrumentation, standby liquid control, flux monitor, and drain line exposed to reactor coolant (3.1.1-40)	Cracking due to stress corrosion cracking, Intergranular stress corrosion cracking, cyclic loading	BWR Penetrations and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel and nickel-alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds (3.1.1-41)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel and nickel-alloy vessel shell attachment welds exposed to reactor coolant (3.1.1-42)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Vessel ID Attachment Welds and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant (3.1.1-43)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel and nickel-alloy core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes (3.1.1-44)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Not applicable	Not applicable to PWRs

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
Nickel-alloy core shroud and core plate access hole cover (mechanical covers) (3.1.1-46)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to PWRs
Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant (3.1.1-47)	Loss of material due to pitting and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not applicable to PWRs
Steel and stainless steel Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant (3.1.1-48)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping	No	Not applicable	Not applicable to PWRs
Nickel-alloy core shroud and core plate access hole cover (welded covers) (3.1.1-49)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and, for BWRs with a crevice in the access hole covers, augmented inspection using UT or other demonstrated acceptable inspection of the access hole cover welds	No	Not applicable	Not applicable to PWRs

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 low alloy steel top head closure studs and nuts exposed to air with reactor coolant leakage (3.1.1-50)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Reactor Head Closure Studs	No	Not applicable	Not applicable to PWRs
Cast austenitic stainless steel jet pump assembly castings; orificed fuel support (3.1.1-51)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	Not applicable	Not applicable to PWRs
Steel and stainless steel reactor coolant pressure boundary (RCPB) pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high-pressure and high-temperature systems (3.1.1-52)	Cracking due to stress corrosion cracking, loss of material due to wear, loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.1.1)
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 BVPS (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 BVPS (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
Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant > 250°C (> 482°F) (3.1.1-55)	Loss of fracture toughness due to thermal aging embrittlement	Inservice Inspection (IWB, IWC, and IWD). Thermal aging susceptibility screening is not necessary, inservice inspection requirements are sufficient for managing these aging effects. ASME Code Case N-481 also provides an alternative for pump casings.	No	ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD (B.2.2)	Consistent with the GALL Report
Copper alloy > 15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-56)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.1.1)
Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to reactor coolant > 250°C (> 482°F) (3.1.1-57)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (B.2.41)	Consistent with the GALL Report
Steel reactor coolant pressure boundary external surfaces exposed to air with borated water leakage (3.1.1-58)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion (B.2.7)	Consistent with GALL Report
Steel steam generator steam nozzle and safe end, feedwater nozzle and safe end, AFW nozzles and safe ends exposed to secondary feedwater/steam (3.1.1-59)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to BVPS (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 flux thimble tubes (with or without chrome plating) (3.1.1-60)	Loss of material due to wear	Flux Thimble Tube Inspection	No	Flux Thimble Tube Inspection (B.2.19)	Consistent with the GALL Report
Stainless steel, steel pressurizer integral support exposed to air with metal temperature up to 288°C (550°F) (3.1.1-61)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD)	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.2)	Consistent with the GALL Report
Stainless steel, steel with stainless steel cladding reactor coolant system cold leg, hot leg, surge line, and spray line piping and fittings exposed to reactor coolant (3.1.1-62)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD)	No	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.1.1)
Steel reactor vessel flange, stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant (e.g., upper and lower internals assembly, CEA shroud assembly, core support barrel, upper grid assembly, core support shield assembly, lower grid assembly) (3.1.1-63)	Loss of material due to wear	Inservice Inspection (IWB, IWC, and IWD)	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.2)	Consistent with the GALL Report
Stainless steel and steel with stainless steel or nickel-alloy cladding pressurizer components (3.1.1-64)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.2) and Water Chemistry (B.2.42)	Consistent with the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel-alloy reactor vessel upper head and control rod drive penetration nozzles, instrument tubes, head vent pipe (top head), and welds (3.1.1-65)	Cracking due to primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD) and Water Chemistry and Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.2), Water Chemistry (B.2.42), and Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Head (B.2.29)	Consistent with the GALL Report
Steel steam generator secondary manways and handholds (cover only) exposed to air with leaking secondary-side water and/or steam (3.1.1-66)	Loss of material due to erosion	Inservice Inspection (IWB, IWC, and IWD) for Class 2 components	No	Not applicable	Not Applicable to BVPS (See SER Section 3.1.2.1.1)
Steel with stainless steel or nickel-alloy cladding; or stainless steel pressurizer components exposed to reactor coolant (3.1.1-67)	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable	Not Applicable to BVPS (See SER Section 3.1.2.1.1)
Stainless steel, steel with stainless steel cladding Class 1 piping, fittings, pump casings, valve bodies, nozzles, safe ends, manways, flanges, CRD housing; pressurizer heater sheaths, sleeves, diaphragm plate; pressurizer relief tank components, reactor coolant system cold leg, hot leg, surge line, and spray line piping and fittings (3.1.1-68)	Cracking due to stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.2) and Water Chemistry (B.2.42)	Consistent with the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, nickel-alloy safety injection nozzles, safe ends, and associated welds and buttering exposed to reactor coolant (3.1.1-69)	Cracking due to stress corrosion cracking, primary water stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.2) and Water Chemistry (B.2.42)	Consistent with the 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 stress corrosion cracking, thermal and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping	No	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.2), Water Chemistry (B.2.42), and One-Time Inspection of ASME Code Class 1 Small Bore Piping (B.2.31)	Consistent with the GALL Report
High-strength low alloy steel closure head stud assembly exposed to air with reactor coolant leakage (3.1.1-71)	Cracking due to stress corrosion cracking; loss of material due to wear	Reactor Head Closure Studs	No	Reactor Head Closure Studs (B.2.34)	Consistent with the GALL Report
Nickel-alloy steam generator tubes and sleeves exposed to secondary feedwater/steam (3.1.1-72)	Cracking due to OD stress corrosion cracking and intergranular attack, loss of material due to fretting and wear	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity (B.2.38) and Water Chemistry (B.2.42)	Consistent with the GALL Report
Nickel-alloy steam generator tubes, repair sleeves, and tube plugs exposed to reactor coolant (3.1.1-73)	Cracking due to primary water stress corrosion cracking	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity (B.2.38) and Water Chemistry (B.2.42)	Consistent with the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Chrome plated steel, stainless steel, nickel-alloy steam generator anti-vibration bars exposed to secondary feedwater/steam (3.1.1-74)	Cracking due to stress corrosion cracking, loss of material due to crevice corrosion and fretting	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity (B.2.38) and Water Chemistry (B.2.42)	Consistent with the GALL Report
Nickel-alloy once-through steam generator tubes exposed to secondary feedwater/steam (3.1.1-75)	Denting due to corrosion of carbon steel tube support plate	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.1.1)
Steel steam generator tube support plate, tube bundle wrapper exposed to secondary feedwater/steam (3.1.1-76)	Loss of material due to erosion, general, pitting, and crevice corrosion, ligament cracking due to corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Steam Generator Tube Integrity (B.2.38) and Water Chemistry (B.2.42)	Consistent with the GALL Report
Nickel-alloy steam generator tubes and sleeves exposed to phosphate chemistry in secondary feedwater/steam (3.1.1-77)	Loss of material due to wastage and pitting corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.1.1)
Steel steam generator tube support lattice bars exposed to secondary feedwater/steam (3.1.1-78)	Wall thinning due to flow-accelerated corrosion	Steam Generator Tube Integrity and Water Chemistry	No	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel-alloy steam generator tubes 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	Steam Generator Tube Integrity (B.2.38) and Water Chemistry (B.2.42)	Consistent with the GALL Report
Cast austenitic stainless steel reactor vessel internals (e.g., upper internals assembly, lower internal assembly, CEA shroud assemblies, control rod guide tube assembly, core support shield assembly, lower grid assembly) (3.1.1-80)	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (B.2.40)	Consistent with the GALL Report
Nickel-alloy or nickel-alloy clad steam generator divider plate exposed to reactor coolant (3.1.1-81)	Cracking due to primary water stress corrosion cracking	Water Chemistry	No	Water Chemistry (B.2.42)	Consistent with the GALL Report
Stainless steel steam generator primary side divider plate exposed to reactor coolant (3.1.1-82)	Cracking due to stress corrosion cracking	Water Chemistry	No	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.1.1)
Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor vessel internals and reactor coolant pressure boundary components exposed to reactor coolant (3.1.1-83)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry (B.2.42)	Consistent with the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Nickel-alloy steam generator components such as, secondary side nozzles (vent, drain, and instrumentation) exposed to secondary feedwater/steam (3.1.1-84)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection or Inservice Inspection (IWB, IWC, and IWD).	No	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.1.1)
Nickel-alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.1.1-85)	None	None	No	None	Consistent with the GALL Report
Stainless steel piping, piping components, and piping elements exposed to air - indoor uncontrolled (External); air with borated water leakage; concrete; gas (3.1.1-86)	None	None	No	None	Consistent with the GALL Report
Steel piping, piping components, and piping elements in concrete (3.1.1-87)	None	None	No	Not applicable	Not applicable to BVPS (See SER Section 3.1.2.1.1)

The staff's review of the reactor vessel, reactor vessel internals, and RCS component groups followed any one of several approaches. One approach, documented in SER Section 3.1.2.1, 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 3.1.2.2, 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 3.1.2.3, 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 reactor vessel, reactor vessel internals, and RCS components is documented in SER Section 3.0.3.

3.1.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.1.2.1, the applicant identifies the materials, environments, AERMs, and the following programs that manage aging effects for the reactor vessel, reactor vessel internals, and RCS components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- Boric Acid Corrosion Program
- Closed-Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- Flux Thimble Tube Inspection Program
- Nickel-Alloy Nozzles and Penetrations Program
- Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads Program
- One-Time Inspection Program
- One-Time Inspection of ASME Code Class 1 Small Bore Piping Program
- PWR Vessel Internals Program
- Reactor Head Closure Studs Program
- Reactor Vessel Integrity Program
- Steam Generator Tube Integrity Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- Water Chemistry Program

LRA Tables 3.1.2-1 through 3.1.2-3 summarizes AMRs for the reactor vessel, reactor vessel internals, and RCS components and indicates AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency 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 line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

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

AMP. The staff audited these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

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

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

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

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the reactor vessel, reactor vessel internals, and RCS 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, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are providing in the subsection that follows

3.1.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.1.1, items 12, 35, 66, 75, and 84, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS does not have once-through steam generators. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no once-through steam generators. BVPS steam generators are recirculating, as described in UFSAR Sections 4.2.2.4 for Unit 1 and 5.4.2.4 for Unit 2. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, item 28, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS does not have impingement plates. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS does not have impingement plates. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, item 52, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because in BVPS (1) the associated bolting is not subject to prolonged or frequent wetting, (2) the materials A325 or A490 common to high strength bolts are not found in any Reactor Vessel, Vessel Internals, or Reactor Coolant System mechanical closure bolting, and (3) BVPS does not use molybdenum or disulfate thread lubricants. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claims for the bolting and bolting environmental conditions. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, item 53, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS does not have steel components of the Class 1 Reactor Vessel, Vessel Internals, or Reactor Coolant System exposed to closed cycle cooling water. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS does not have steel components of the Class 1 Reactor Vessel, Vessel Internals, or Reactor Coolant System exposed to closed cycle cooling water. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, items 54 and 56, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS does not have copper alloy components in the Class 1 Reactor Vessel, Vessel Internals, or Reactor Coolant System. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS does not have copper alloy components in the Class 1 Reactor Vessel, Vessel Internals, or Reactor Coolant System. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, item 59, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS addresses loss of material for steam generator components exposed to secondary feedwater steam in items 3.1.1-16, 3.1.1-32, and 3.1.1-76. The staff reviewed the documentation supporting the applicant's AMR evaluation in items 3.1.1-16, 3.1.1-32, and 3.1.1-76, and no BVPS AMR line items roll up to this item. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, item 62, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS AMR line items roll up to this item. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that cracking of stainless steel components exposed to reactor coolant is addressed in the evaluation of fatigue or SCC in other line items. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, item 67, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS AMR line items roll up to this item. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that cracking of stainless steel or nickel components or cladding exposed to reactor coolant is addressed in the evaluation of fatigue or SCC in other line items. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, items 77, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS does not use phosphate chemistry. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS does not use phosphate chemistry. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, items 78, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS steam generators have tube support plates instead of lattice bars.

The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS steam generators have tube support plates instead of lattice bars. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, items 82, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because the BVPS steam generator primary side divider plate is fabricated from nickel-alloy and not stainless steel. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS steam generator primary side divider plate is fabricated from nickel-alloy. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, items 87, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no components within the scope of license renewal in concrete in the Reactor Vessel, Internals, or Reactor Coolant Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no components within the scope of license renewal in concrete in the Reactor Vessel, Internals, or Reactor Coolant Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

3.1.2.1.2 Aging Management of Loss of Fracture Toughness due to Thermal Aging in CASS Reactor Vessel Internal (RVI) Components

In the applicant’s letter of July 21, 2008, the applicant amended its AMRs in LRA Table 3.1.2-2 that pertain to the management of loss of fracture toughness due to thermal aging embrittlement and neutron irradiation embrittlement of its cast austenitic stainless steel (CASS) reactor vessel internal (RVI) components. In this amendment of the LRA, the applicant changed is basis for managing loss of fracture toughness due to thermal aging embrittlement in the CASS RVI components from AMP B.2.40, ”Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program,” to the applicant’s commitments for managing the aging effects attributed to RVI components, as provided in Commitment No. 18 of UFSAR Supplement Table A.4-1 for Unit 1 and Commitment No. 20 of UFSAR Supplement Table A.5-1 for Unit 2.

The corresponding AMRs in the GALL Report that relate to these AMR items are AMR item 80 in Table 1 of the GALL Report, Revision 1, Volume 1 (GALL1) and AMR items IV.B2-21 and IV.B2-37 in Table IV.B2 of the GALL Report, Revision 1, Volume 2 (GALL2), as applicable to the management of loss of fracture toughness due to thermal aging embrittlement in CASS Westinghouse-designed RVI upper support columns and lower support castings and lower support plate columns. These GALL1 and GALL2 AMR items identify that the environment that can induce loss of fracture toughness of these CASS components as a result of thermal aging embrittlement and neutron irradiation embrittlement is the borated reactor coolant at an elevated temperature in excess of 250°C (i.e., >482°F), and as exposed to an integrated neutron flux (i.e., neutron fluence).

In these AMRs, the staff recommends that a program corresponding to GALL AMP XI.M13, “Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)” be credited for aging management of loss of fracture toughness in these CASS components.

The staff noted that the applicant’s amendment of these stated AMRs in LRA Table 3.1.2-2 changed the aging management basis in the AMRs from being consistent with GALL AMR items IV.B2-21 and IV.B2-37 to being consistent with the recommendations in these GALL AMR items except for the fact that the commitments in Commitment No. 18 of UFSAR Supplement Table A.4-1 for Unit 1 and Commitment No. 20 of UFSAR Supplement Table A.5-1 for Unit 2 are now being credited as the basis for aging management in lieu of an AMP corresponding to GALL AMP XI.M13, “Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS).”

In the 2005 update of the SRP-LR and the GALL Report, the NRC took a recommended position that aging management of PWR vessel internals needs to be done on a consistent basis among licensed PWRs in the U.S. to account for the fact that not all of the PWR RVI components are ASME Code Class and to account for the fact that additional aging management measures may be necessary for some of the non-ASME Code Class PWR RVI components. Hence, the staff updated its aging management basis in the AMRs for PWR RVI components in the GALL Report through the following recommended commitment that was recommended to be adopted in the UFSAR Supplements for PWR LRAs:

> "(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."

Thus, for current Westinghouse-designed PWR LRAs pending staff approval (including that for BVPS Units 1 and 2), the staff's AMR basis for managing the aging effects attributed to Westinghouse-designed (as well as to Babcock and Wilcox-designed and Combustion Engineering-designed) PWR RVI components were amended to state:

> "The AMP column was changed to delete reference to XI.M16 (AMP M16 was also deleted from the GALL report) and instead require a commitment in the FSAR Supplement to apply industry programs to be developed in the future for proper management of reactor internals. Also, added to the further evaluation column the requirement for the licensee commitment to be confirmed."

The staff noted that the commitment that is recommended by the staff includes a provision for PWR applicants to submit an inspection plan for their RVI components that is based on the industry's augmented inspection program recommendations for PWR RVI components to the NRC for review and approval at least two years prior to entering the period of extended operation. The staff verified that the applicant includes the applicable commitment for the RVI components in Commitment No. 18 of LRA UFSAR Supplement Table A.4-1 for BVPS Unit 1 and in Commitment No. 20 of LRA UFSAR Supplement Table A.5-1 for BVPS Unit 2.

The staff also noted that the applicant's amended basis to credit the commitments for managing the aging effects for the BVPS RVI components (including the management loss of fracture toughness in the CASS RVI components as a result of thermal aging embrittlement and neutron irradiation embrittlement) is in conformance with the staff's recommended commitment for RVI components as given in the applicable AMRs of GALL2 Table IV.B2. As a result of this review and the bases stated above, the staff finds that the applicant's amended and alternate basis for managing loss of fracture toughness in the CASS RVI components as a result of thermal aging embrittlement, and neutron irradiation embrittlement is acceptable because it is in conformance with staff's recommendation in GALL2 that a commitment be placed on the LRA to manage the aging effects that are applicable to the BVPS RVI components.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing 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 with its AMRs. Therefore, 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).

3.1.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.1.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the reactor vessel, reactor vessel internals, and RCS components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of fracture toughness due to neutron irradiation embrittlement
- cracking due to stress corrosion cracking (SCC) and intergranular stress corrosion cracking (IGSCC)
- crack growth due to cyclic loading
- 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 irradiation-assisted SCC (IASCC)
- cracking due to primary water SCC
- wall thinning due to flow-accelerated corrosion
- changes in dimensions due to void swelling
- cracking due to SCC and primary water SCC
- cracking due to SCC, primary water SCC, and irradiation-assisted SCC
- 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 audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.1.2.2.The staff's review of the applicant's further evaluation follows.

3.1.2.2.1 Cumulative Fatigue Damage

LRA Section 3.1.2.2.1 states that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1).

In LRA Table 3.1.1, item 1, the applicant states that the AMR result line in the GALL Report is not used because BVPS has a Westinghouse reactor vessel and does not have a pressure vessel support skirt.

The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that BVPS does not have a pressure vessel support skirt. On the basis that BVPS does not have a pressure vessel support skirt, the staff agrees with the applicant's determination that the AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.1.1, items 2, 3, and 4, the applicant states that the AMR result lines are not applicable.

The staff reviewed the corresponding AMR result lines in the SRP-LR and noted that they apply only to boiling water reactors (BWRs). On this basis, the staff agrees with the applicant's determination that LRA Table 3.1.1, items 2, 3, and 4, are not applicable, because BVPS is a PWR.

The staff noted that LRA Table 3.1.1,items 5 through 10, are AMR result lines with an aging effect of cumulative fatigue. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

The GALL report for LRA Table 3.1.1 Item #5 references GALL AMR Item IV.B1-14, IV.B2-31, IV.B3-24 and IV.B4-37, which recommends that this is a TLAA and is evaluated in accordance with 10 CFR 54.21(c) to manage cumulative fatigue damage in the Reactor Coolant System. The staff verified that only core baffle/former assembly components, core barrel components, instrumental support structure components, lower internal assembly components, upper internal assembly components and RCCA guide tube assembly components that align to GALL AMR IV.B2-31 for the Reactor Vessel Internals that are fabricated from stainless steel, nickel-alloy and cast austenitic stainless steel materials are applicable to BVPS.

The GALL report for LRA Table 3.1.1 Item #6 references GALL AMR Item IV.D1-21 and IV.D2-15, which recommends that this is a TLAA and is evaluated in accordance with 10 CFR 54.21(c) to manage cumulative fatigue damage in the Reactor Coolant System. The staff verified that only steam generator components that align to GALL AMR IV.D1-21 for the Reactor Coolant System that are fabricated from nickel-alloy materials are applicable to BVPS.

The GALL report for LRA Table 3.1.1 Item #7 references GALL AMR Item IV.C2-23, IV.C2-10, IV.D1-11, IV.D2-10 and IV.A2-4, which recommends that this is a TLAA and is evaluated in accordance with 10 CFR 54.21(c) to manage cumulative fatigue damage in the Reactor Coolant System. The staff verified that only bolting, closure head, pressurizer components and steam generator components that align to GALL AMR IV.A2-4, IV.C2-10 and IV.D1-11 for the Reactor Coolant System that are fabricated from steel, stainless steel, steel with nickel-alloy cladding and high-strength low-alloy steel materials are applicable to BVPS.

The GALL report for LRA Table 3.1.1 Item #8 references GALL AMR Item IV.C2-25, which recommends that this is a TLAA and is evaluated in accordance with 10 CFR 54.21(c) to manage cumulative fatigue damage in the Reactor Coolant System. The staff verified that only flexible hose, hydraulic isolator, orifices, piping, pressurizer components, reactor coolant pump components, thermal sleeve and tubing that align to GALL AMR IV.C2-25 for the Reactor Coolant System that are fabricated from steel with stainless steel cladding, stainless steel, nickel-alloy and cast austenitic stainless steel materials are applicable to BVPS.

The GALL report for LRA Table 3.1.1 Item #9 references GALL AMR Item IV.A2-21, which recommends that this is a TLAA and is evaluated in accordance with 10 CFR 54.21(c) to manage cumulative fatigue damage in the Reactor Coolant System. The staff verified that only bottom-mounted guide tube components, closure head and flange, core support pad and guide lug, head penetrations, nozzles, penetrations and vessel shell components that align to GALL AMR IV.A2-21 for the Residual Heat Removal, Reactor Core Isolation Cooling and High Pressure Coolant Injection System that are fabricated from steel with stainless steel cladding, stainless steel, nickel-alloy, cast austenitic stainless steel materials and SA508-Cl 2 forgings clad with stainless steel using a high-heat-input welding process materials are applicable to BVPS.

The GALL report for LRA Table 3.1.1 Item #10 references GALL AMR Item IV.D1-8 and IV.D2-3, which recommends that this is a TLAA and is evaluated in accordance with 10 CFR 54.21(c) to manage cumulative fatigue damage in the Reactor Coolant System. The staff verified that only steam generator components that align to GALL AMR IV.D1-8 for the Reactor Coolant System that are fabricated from stainless steel materials are applicable to BVPS.

3.1.2.2.2 Loss of Material due to Pitting and Crevice Corrosion

Once Through PWR SG Shell Assemblies and BWR Reactor Vessel Penetration and RCIC Components. SRP-LR Section 3.1.2.2.2.1 states that loss of material due to general corrosion, pitting corrosion, and crevice corrosion may occur in steel PWR steam generator shell assemblies that are exposed to feedwater or to steam and in steel BWR top head enclosure (without cladding) top head nozzles (vent, top head spray) or reactor core isolation cooling (RCIC), and spare that are exposed to the reactor coolant. The SRP-LR Section states that the existing program relies on control of reactor water chemistry to mitigate corrosion, but qualifies this statement by stating that control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. The SRP-LR Section therefore recommends that the effectiveness of the chemistry control program be verified to ensure that corrosion is not occurring. The SRP-LR Section states that the GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program, and 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.

For the BWR components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 11 in Table 1 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item IV.A1-11 in Table IV.A1 of the GALL Report, Revision 1, Volume 2 (GALL2). The applicant identified that the BVPS units are PWR-designed and guidance for these BWR components are not applicable to the BVPS LRA.

Thus, based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.1.2.2.2, Item (1) and the referenced GALL AMRs is not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR components and because the BVPS units are Westinghouse-designed PWR reactors.

With regard to aging management of loss of material in the PWR SG shell assemblies under exposure to either feedwater or steam, the GALL AMRs referred to by this SRP-LR Section are AMR item 12 in Table 1 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item IV.D2-8 in Table IV.D2 of the GALL Report, Revision 1, Volume 2 (GALL2), as applicable to the evaluation of loss of material due to general, pitting, and crevice corrosion in once-through SGs. The applicant identified that the BVPS units are Westinghouse-designed PWR with recirculating SGs. The applicant therefore stated that the guidance in SRP-LR Section 3.1.2.2.2, Item (1) and in AMR item 12 of Table 1 of GALL1 and AMR item IV.D2-8 of GALL2 are not applicable to the BVPS LRA because the BVPS SGs are not once-through SG designs. Based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the guidance for PWR SG components in SRP-LR Section 3.1.2.2.2, Item (1) and the referenced GALL AMRs is not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to PWR with once-through SG designs and because the SGs at BVPS are Westinghouse-design recirculating SGs.

The staff has verified that the applicant includes its AMRs on loss of material due to general, pitting, and crevice corrosion of its steel SG components under exposure to the reactor coolant in AMR 3.1.1-83 of LRA Table 3.1.1, and in the AMRs for steam generator components in LRA Table 3.1.2-3 that align to LRA AMR 3.1.1-83. The staff has evaluated these AMRs in SER Section 3.1.2.1.

BWR Isolation Condenser Components*.* SRP-LR Section 3.1.2.2.2, Item (2) states that loss of material due to pitting and crevice corrosion could occur in stainless steel BWR isolation condenser components exposed to reactor coolant, and that loss of material due to general, pitting, and crevice corrosion could occur in steel BWR isolation condenser components under exposure to the reactor coolant. The SRP-LR Section states that the existing program relies on control of reactor water chemistry to mitigate corrosion, but qualifies this statement by identifying that control of water chemistry does not preclude loss of material due to pitting and crevice corrosion from occurring at locations of stagnant flow conditions. Therefore, the SPR-LR Section recommends that the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring, and states that the GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. The SRP-LR Section 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.

For the BWR isolation condenser components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 13 in Table 1 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item IV.C1-6 in Table IV.C1 of the GALL Report, Revision 1, Volume 2

(GALL2). The applicant identified that the BVPS units are PWR-designed and guidance for these BWR components are not applicable to the BVPS LRA. Thus, based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.1.2.2.2, Item (2) and the referenced GALL AMRs is not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR components and because the BVPS units are Westinghouse-designed PWR reactors.

BWR Reactor Vessel Components Exposed to the Reactor Coolant. SPR-LR Section 3.1.2.2.2, Item (3) states that loss of material due to pitting and crevice corrosion could occur in BWR reactor vessel (RV) flanges, nozzles, penetrations, pressure housings, safe ends, and vessel shells, heads and welds that are made of stainless steel, nickel-alloy, or steel with internal stainless steel or nickel-alloy cladding under exposure to reactor coolant. The SRP-LR Section states that the existing program relies on control of reactor water chemistry to mitigate corrosion, but qualifies this statement by identifying that control of water chemistry does not preclude loss of material due to pitting and crevice corrosion from occurring at locations of stagnant flow conditions. Therefore, the SPR-LR Section recommends that the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring, and states that the GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. The SRP-LR Section 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.

For the BWR RV components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 14 in Table 1 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item IV.A1-8 in Table IV.A1 of the GALL Report, Revision 1, Volume 2 (GALL2). The applicant identified that the BVPS units are PWR-designed and guidance for these BWR components are not applicable to the BVPS LRA. Thus, based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.1.2.2.2, Item (1) and the referenced GALL AMRs is not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR RV components and because the BVPS units are Westinghouse-designed PWR reactors.

PWR Steam Generator Shell and Transition Cone. SRP-LR Section 3.1.2.2.2.4 states that loss of material due to general, crevice, and pitting corrosion could occur in the steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam. The existing program relied on control of water chemistry to mitigate corrosion and inservice inspections to detect loss of material. The extent and schedule of the existing steam generator inspections are designed to ensure that flaws cannot attain a depth sufficient to threaten the integrity of the welds. However, according to NRC Information Notice (IN) 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators," the program may not be sufficient to detect pitting and crevice corrosion and pitting corrosion. NUREG-1801 clarifies that this issue is limited to Westinghouse Model 44 and 51 Steam Generators where a high-stress region exists at the shell-to-transition cone weld. In that case, the GALL Report recommends augmented inspections to manage this aging effect.

The staff noted that the additional inspections proposed by the applicant the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program for Class 2 components. The staff also noted that the BVPS Unit 1 steam generators (SGs) have been replaced with Model 54F generators and are therefore the ultrasonic testing (UT) examination detection capability topic raised in SRP-LR Section 3.1.2.2.2.4 is not applicable to the BVPS Unit 1 SGs. The staff has verified that, in LRA Table 3.1.2-3, the applicant has aligned its AMR on loss of material in the steel Model 54F SG cones and shells for BVPS Unit 1 to GALL AMR IV.D1-12, and that the applicant credits both its Water Chemistry Program and its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to manage loss of material in the BVPS Unit 1 SG cones and shells. They confirmed that the applicant's AMR for the SG cones and shells is consistent with the staff's AMR basis in GALL AMR IV.D1-12 for PWR recirculating SGs that are not Westinghouse Model 44 or 51 SGs (i.e., the applicable aging effect of loss of material due to general, pitting, and crevice corrosion is applicable but does not require any further evaluation under the recommendations of SRP-LR Section 3.1.2.2.2.4). Thus, the staff concludes that the applicant has provided an acceptable basis for concluding that the topic raised in SRP-LR Section 3.1.2.2.2.4 is not applicable to the applicant's AMR on loss of materials in the BVPS Unit 1 SG because these SGs are not Westinghouse Model 44 or 51 SG designs. Instead, the staff's evaluation of the applicant's AMR on loss of material in the BVPS Unit 1 SG cones and shells and its basis for managing loss of material in the BVPS Unit 1 Model 54F SG shells is given in SER Section 3.1.2.1 for AMRs that are consistent with the GALL Report not requiring further evaluation under the guidance of the SRP-LR.

The staff noted however that the BVPS the Unit 2 steam generators are Westinghouse Model 51 SGs and thus, the recommendations in SRP-LR Section 3.1.2.2.2.4 are applicable to the BVPS Unit 2 SGs. The staff has confirmed that, in LRA Table 3.1.2-3, the applicant has aligned its AMR on loss of material in the steel Model 51 SG shells and cones for BVPS Unit 2 to GALL AMR IV.D1-12, and that the applicant credits both its Water Chemistry Program and its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to manage loss of material in the BVPS Unit 1 SG cones and shells. The staff confirmed that the applicant's AMR for the SG cones and shells is consistent with the staff's AMR basis in GALL AMR IV.D1-12 for Westinghouse Model 44 or 51 SGs, and that in LRA Section 3.1.2.2.2.4, the applicant provided its further evaluation discussion of its basis to manage loss of material due to pitting and crevice corrosion in the BVPS Unit 2 cones and shells. The staff noted that in this section, the applicant made the following statement regarding its evaluation for the BVPS Unit 2 SG cones and shells:

> Additional inspection requirements have been incorporated into the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program (Section B.2.2) to detect general and pitting corrosion and the resulting corrosion-fatigue cracking in the Unit 2 Model 51 steam generators.

The staff's guidance in SRP-LR Section 3.1.2.2.2.4 references NRC Information Notice (IN) 90-04 which discussed impacts of abnormal geometries in Westinghouse Model 44 and 51 SG shell-to-transition cone welds on UT detection capability. In this IN, the staff indicated that, for ultrasonic tests (UT) performed on these welds, the intensity of background noise signals (reflectors) resulting from the weld geometries could be high and could potentially mask any UT reflectors resulting from actual flaws in the welds (e.g., pits or cracks). The staff therefore recommended, for these SG designs, that applicants develop methods and procedures that would result in a lowering of the background noise levels resulting from the welds geometries. The IN listed adjustment of the gain of the UT detection equipment as an example of a method that could be used to reduce the noise levels resulting from the weld geometry.

The staff noted that the applicant did address the staff's recommendation in SRP-LR to develop additional inspection procedures to inspection of Westinghouse Model 44 or 51 SG shell-to-transition cone welds. In its LRA update dated December 19, 2008, the applicant amended LRA Section 3.1.2.2.2.4 to clarify how the additional procedures were modified to address the staff's recommendations in IN 90-04. The staff finds that the amended basis is acceptable because the applicant has clarified why its current procedures are adequate to manage loss of material due to pitting and crevice corrosion in the BVPS Unit 2 SG cone-to-shell transition welds consistent with the NRC IN 90-04 guidance and because the applicant used the augmented inspection methods recommended in IN 90-04 to confirm the absence of UT geometric reflectors that might otherwise mask indications from actual flaws in these transition cone welds.

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

The staff reviewed LRA Section 3.1.2.2.3 against the following criteria in SRP-LR Section 3.1.2.2.3:

(1) LRA Section 3.1.2.2.3 states that neutron irradiation embrittlement is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.2 documents the staff's review of the applicant's evaluation of this TLAA.

    Section 3.1.2.2.3 of the Beaver Valley Power Station (BVPS) License Renewal Application (LRA) provides aging management review (AMR) results addressing the loss of reactor vessel (RV) fracture toughness due to neutron irradiation embrittlement. The staff reviewed LRA Section 3.1.2.2.3 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging due to RV neutron embrittlement will be adequately managed so that the intended function of the RV will be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff verified that LRA Section 3.1.2.2.3 appropriately identifies (1) the time-limited aging analyses (TLAAs) associated with RV neutron embrittlement, and (2) the RV Integrity Aging Management Program (AMP) for monitoring the effects of RV neutron embrittlement. The RV neutron embrittlement TLAAs are presented in Section 4.2 of the LRA. The RV Integrity AMP is presented in Appendix B of the LRA, Section B.2.35. The staff determined that the applicant's RV Integrity AMP is consistent with NUREG-1801, "Generic Aging Lessons Learned Report," (GALL) AMP XI.M31, "Reactor Vessel Surveillance." The staff's evaluation of the RV neutron embrittlement TLAAs is documented in SER Section 4.2. The staff's evaluation of the RV Integrity AMP is documented in SER Section B.2.35.

(2) LRA Section 3.1.2.2.3 addresses loss of fracture toughness due to neutron irradiation embrittlement that may occur in the reactor vessel beltline, shell, nozzle, and welds. A materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. The safety injection lines connecting to the loops are not exposed to neutron flux, and the safety injection nozzles are not managed by the Reactor Vessel Integrity Program. LRA Section B.2.35 presents the results of the evaluation of the Reactor Vessel Integrity Program for license renewal.

SRP-LR Section 3.1.2.2.3 states that loss of fracture toughness due to neutron irradiation embrittlement may occur in BWR and PWR reactor vessel beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance programs are plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further staff evaluation is required for license renewal. Specific recommendations for an acceptable AMP are provided in GALL Report Chapter XI, Section M31.

Section 3.1.2.2.3.2 of the Beaver Valley Power Station (BVPS) License Renewal Application (LRA) provides aging management review (AMR) results addressing reactor vessel (RV) neutron embrittlement. The staff reviewed LRA Section 3.1.2.2.3.2 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging due to RV neutron embrittlement will be adequately managed so that the intended function of the RV will be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff verified that LRA Section 3.1.2.2.3.2 appropriately identifies the RV Integrity Aging Management Program (AMP) for monitoring the effects of RV neutron embrittlement. The RV Integrity AMP is presented in Appendix B of the LRA, Section B.2.35. The staff determined that the applicant's RV Integrity AMP is consistent with NUREG-1801, "Generic Aging Lessons Learned Report," (GALL) AMP XI.M31, "Reactor Vessel Surveillance." The staff's evaluation of the RV Integrity AMP is documented in SER Section B.2.35.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.3 criteria. For those line items that apply to LRA Section 3.1.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

BWR Reactor Vessel Top Head Enclosure Flange Leakage Detection Lines. LRA Section 3.1.2.2.4.1 provides the applicant's discussion on whether the recommended guidance and the AMR recommendations in GALL AMR IV.A1-10 on management of cracking in BWR RV flange leakage detection lines is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that SRP-LR Section 3.1.2.2.4.1 on cracking of BWR vessel flange leakage detections lines is applicable to BWR plants only.

SRP-LR Section 3.1.2.2.4.1 identifies cracking due to SCC and IGSCC could occur in the stainless steel and nickel-alloy BWR top head enclosure vessel flange leak detection lines. The SRP-LR Section states that the GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting cracking due to SCC and IGSCC.

SRP-LR Section 3.1.2.2.4.1 references AMR Item 19 in Table 1 of the GALL Report, Volume 1 and AMR Item IV.A1-10 of the GALL Report, Volume 2 on management of cracking due to SCC and IGSCC in stainless steel and nickel-alloy BWR reactor vessel (RV) flange leakage detection lines that are exposed to the treated water environment of the reactor coolant. The aging management position taken in these GALL-based AMRs is consistent with the staff's position and recommendations in SRP-LR Section 3.1.2.2.4.1.

The staff determined that NUREG-1390, Volume 19 identifies the BVPS reactors as Westinghouse 3-Loop PWRs with dry ambient containments. Based on this review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.4.2 and in GALL AMR IV.C1-4 are not applicable to the BVPS LRA because the staff guidance is applicable BWR isolation condenser components and because the BVPS reactors are Westinghouse-designed PWRs.

<u>BWR Isolation Condenser Components</u>. LRA Section 3.1.2.2.4.2 provides the applicant's discussion on whether the recommended guidance and the AMR recommendations in GALL AMR IV.C1-4 on management of cracking due to stress corrosion cracking (SCC) and/or intergranular stress corrosion cracking (IGSCC) in stainless steel BWR isolation condenser components is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that SRP-LR Section 3.1.2.2.4.2 on cracking of BWR isolation condenser components is applicable to BWR plants only.

SRP-LR Section 3.1.2.2.4.2 identifies cracking due to SCC/IGSCC could occur in the stainless steel BWR isolation condenser components under exposure to the treated water environment of the reactor coolant. The SRP-LR sections states that the GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting cracking due to SCC/IGSCC.

SRP-LR Section 3.1.2.2.4.2 references AMR Item 20 in Table 1 of the GALL Report, Volume 1 and AMR Item IV.C1-4 of the GALL Report, Volume 2 on management of cracking due to SCC and IGSCC in stainless steel BWR isolation condenser components that are exposed to the treated water environment of the reactor coolant. The aging management position taken in these GALL-based AMRs is consistent with the staff's position and recommendations in SRP-LR Section 3.1.2.2.4.2.

The staff determined that NUREG-1390, Volume 19 identifies the BVPS reactors as Westinghouse 3-Loop PWRs with dry ambient containments. Based on this review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.4.2 and in GALL AMR IV.C1-4 are not applicable to the BVPS LRA because the staff guidance is applicable BWR isolation condenser components and because the BVPS reactors are Westinghouse-designed PWRs.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

LRA Section 3.1.2.2.5 states that growth of intergranular separations (underclad cracks) in the heat-affected zone under austenitic steel cladding is a TLAA as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.7 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 addresses the applicant's evaluation that on whether the recommended guidance in SRP-LR Section 3.1.2.2.6, "Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement and Void Swelling," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that loss of fracture toughness could occur in the reactor vessel internal (RVI) components made from nickel-alloy or stainless steel (including cast austenitic stainless steels) as result of neutron irradiation embrittlement or void swelling.

The applicant states that it credits its commitments for PWR RVI components to manage loss of fracture toughness due to neutron irradiation embrittlement or void swelling in the nickel-alloy and stainless steel RVI components and includes these commitments in Commitment No. 18 of Unit 1 UFSAR Supplement Table A4-1 and Commitment No. 20 of Unit 2 UFSAR Supplement Table A5-1, as follows:

(1) Participate in the industry programs applicable to BVPS Unit 1/Unit 2 for investigating and managing aging effects on reactor internals;

(2) Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1/Unit 2 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 the BVPS Unit 1/Unit 2 reactor internals to the NRC for review and approval."

Staff Evaluation. SRP-LR Section 3.1.2.2.6 states that fracture toughness due to neutron irradiation embrittlement and void swelling could occur in stainless steel and nickel-alloy reactor vessel internals components exposed to reactor coolant and neutron flux. The SRP-LR Section states that the GALL Report recommends no further aging management review if the applicant provides a commitment in the FSAR 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.

For applicable nickel-alloy and stainless steel RVI components, SRP-LR Section 3.1.2.2.6 invokes AMR Item 22 in Table 1 of the GALL Report, Volume 1, and specific AMR items in the GALL Report Volume 2, as applicable to the management of loss of fracture toughness due to neutron irradiation embrittlement or void swelling in the following Westinghouse-designed RVI components:

- plates in the baffle and former assemblies (GALL AMR IV.B2-3)
- bolts and screws in the baffle and former assemblies (GALL AMR IV.B2-6)

- core barrel (CB), CB flange, CB outlet nozzles, and thermal shield (GALL AMR IV.B2-9)
- fuel alignment pins, core support plate column bolts, clevis insert bolts in the lower internal assembly (GALL AMR IV.B2-17)
- lower core plate in the lower internal assembly (GALL AMR IV.B2-18)
- lower support casting or forging and lower support plate columns in the lower internal assembly (GALL AMR IV.B2-22)

The staff's guidance in these AMR items is consistent with the guidance in SRP-LR Section 3.1.2.2.6.

The staff reviewed LRA Section 3.1.2.2.6 and the applicant's AMRs of management of loss of fracture toughness due to neutron irradiation embrittlement and void swelling in the BVPS RVI components against the staff's recommended guidance in SRP-LR Section 3.1.2.2.6; AMR Item 22 in Table 1 of the GALL Report, Volume 1; and AMR items IV.B2-3, IV.B2-6, IV.B2-9, IV.B2-17, IV.B2-18, and IV.B2-22 in the GALL Report, Volume 2.

The staff verified that the applicant does include the applicable AMR items in the LRA Table 3.1.2-2 that align to the recommendations in GALL AMRs IV.B2-3, IV.B2-6, IV.B2-9, IV.B2-17, IV.B2-18, and IV.B2-22, as applicable to the following nickel-alloy and stainless steel RVI components:

- core baffle/former assembly bolts (aligning to GALL AMR IV.B2-6)
- core baffle assembly and former assembly plates (aligning to GALL AMR IV.B2-3)
- core barrel shell, ring, flange, nozzle, and thermal shield/pad (aligning to GALL AMR IV.B2-9)
- core barrel assembly bolts (aligning to GALL AMR IV.B2-9)
- lower internals assembly core support forging and lower support column (aligning to GALL AMR IV.B2-22)
- lower internals assembly support column bolts, clevis insert bolts, and fuel alignment pins (aligning to GALL AMR IV.B2-17)
- lower internals assembly core plate (aligning to GALL AMR IV.B2-18)

For these nickel-alloy or stainless steel RVI component commodity groups, the staff verified that the applicant credits its commitments for PWR RVI components to manage loss of fracture toughness due to neutron irradiation embrittlement or void swelling in the nickel-alloy and stainless steel RVI components, as follows:

> "For the PWR Vessel Internals Program, regarding activities for managing the aging of Reactor Vessel internal components and structures, BVPS commits to:
>
> (1) Participate in the industry programs applicable to BVPS Unit 1/Unit 2 for investigating and managing aging effects on reactor internals;

(2) Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1/Unit 2 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 the BVPS Unit 1/Unit 2 reactor internals to the NRC for review and approval."

The staff verified that the applicant includes this commitment in Commitment No. 18 of LRA UFSAR Supplement Table A.4-1 for BVPS Unit 1 and in Commitment No. 20 of LRA UFSAR Supplement Table A.5-1 for BVPS Unit 2. As a result as this review, the staff finds that the applicant has credited an acceptable AMR basis to manage loss of fracture toughness due to neutron irradiation embrittlement and void swelling in the nickel-alloy and stainless steel components of the core baffle/former assemblies, core barrel assembly, and lower internals assembly because the commitments credited to further evaluate these components, and to manage loss of fracture toughness due to neutron irradiation embrittlement and void swelling in the components, have been verified to be in conformance with the staff's recommended criteria in SRP-LR Section 3.1.2.2.6 and the GALL AMRs that are invoked by this SRP-LR section.

Based on the applicant's crediting of the commitments identified and discussed above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.1.2.2.6 to manage loss of fracture toughness due to neutron irradiation embrittlement and void swelling in the nickel-alloy and stainless steel components of the core baffle/former assemblies, core barrel assemblies, and lower internals assemblies under exposure to the reactor coolant and an integrated neutron flux, and that for these components, the applicant has met the criteria in SRP-LR Section SRP-LR Section 3.1.2.2.6 to manage this aging effect. For those AMR items that apply to LRA Section 3.1.2.2.6, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.7 Cracking Due to Stress Corrosion Cracking

PWR Vessel Bottom Mounted Instrument Guide Tubes. LRA Section 3.1.2.2.7.1 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.1.2.2.7.1, "Cracking Due to Stress Corrosion Cracking, *PWR Vessel Bottom Mounted Instrument Guide Tubes*," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that cracking due to stress corrosion cracking (SCC) could occur in the stainless steel bottom mounted instrument (BMI) guide tubes. The applicant states that it credits its Water Chemistry Program to manage cracking due to SCC in the stainless steel BMI guide tubes as a result of exposure of the tubes to the reactor coolant. The applicant also states that it credits its One-Time Inspection Program to verify the effectiveness of its Water Chemistry Program in managing cracking due to SCC in the BMI guide tubes as a result of exposure to the reactor coolant. The applicant clarifies that the evaluation of cracking due to SCC in the RV flange leakage detection tubes provided in LRA Section 3.1.2.2.13 and that the AMRs for these components are aligned to GALL AMR IV.A2-19 through LRA AMR item 3.1.1-31.

SRP-LR Section 3.1.2.2.7.1 states that cracking due to SCC could occur in the PWR stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument (BMI) guide tubes exposed to reactor coolant. The SRP-LR Section states that the GALL Report recommends further evaluation to ensure that these aging effects are adequately managed and that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed. SRP-LR Section 3.1.2.2.7.1 invokes AMR Item 23 in Table 1 of the GALL Report, Volume 1, and AMR items IV.A2-1 and IV.A2-5 in the GALL Report Volume 2, as applicable to the management of cracking due to SCC in stainless steel BMI guide tubes and in stainless steel reactor vessel (RV) flange leakage detection lines (or tubes). The staff's aging management recommendations in these AMRs are consistent with the guidance in SRP-LR Section 3.1.2.2.7.1.

The staff reviewed LRA Section 3.1.2.2.7.1 and the applicant's AMRs of management of cracking due to SCC in the BVPS BMI guide tubes and RV flange leakage detection tubes against the staff's recommended guidance in SRP-LR Section 3.1.2.2.7.1; AMR Item 23 in Table 1 of the GALL Report, Volume 1; and AMR items IV.A2-1 and IV.A2-5 in the GALL Report, Volume 2. The staff verified that the applicant does include applicable AMR items in LRA Table 3.1.2-1 that align to the recommendations in GALL AMRs IV.A2-1 on management of cracking due to SCC in BMI guide tubes as a result of exposure to the reactor coolant. The staff verified that the applicant credited its Water Chemistry Program to manage cracking due to stress corrosion cracking in the BMI guide tubes as a result of exposure of the tubes to the reactor coolant. The staff also verified that the applicant credits its One-Time Inspection Program to verify the effectiveness of its Water Chemistry Program for managing cracking due to SCC in the stainless steel BMI guide tubes that are exposed to the reactor coolant.

The staff noted that crediting a One-Time Inspection Program to verify the effectiveness of a Water Chemistry Program in precluding or mitigating cracking due to SCC implies that there has not yet been any BVPS-specific or generic experience on cracking due to SCC in these components. These BMI guide tubes are ASME Code Class 1 reactor coolant pressure boundary (RCPB) components. The staff questioned the basis for using a One-Time Inspection Program to manage this aging effect in lieu of a BVPS defined periodic inspection program. In RAI 3.1.2.2.7.1-1, the staff asked the applicant to: (1) identify whether there is any applicable BPVS-specific in industry generic operating experience on cracking due to SCC of stainless steel PWR BMI guide tubes, and (2) justify why a One-Time Inspection Program is justified to manage cracking due to SCC in the BMI guide tubes in lieu of crediting a periodic condition monitoring program, such as the ASME Section XI, Subsections IWB, IWC, and IWD Program, particularly when the component type in question (i.e., BMI guide tube), is categorized as an ASME Code Class 1 RCPB component.

The applicant responded to RAI 3.1.2.2.7.1-1 in a letter dated July 21, 2008. To address the part of the RAI that asked the applicant to clarify whether there is any applicable BVPS specific or industry generic operating experience related to SCC-induced cracking of stainless steel BMI guide tubes, the applicant stated that it has not identified any plant-specific operating experience regarding cracking of the bottom-mounted instrument guide tubes. Further, the applicant stated that a search of the Institute for Nuclear Power Operations (INPO) Operating Experience database identified a 1989 event at Turkey Point in which transgranular stress corrosion cracking (TGSCC) was identified in several bottom-mounted instrument guide tubes and that the cracking occurred above the seal table due to chloride contamination and intermittent wetting.

The applicant stated that additionally, NRC Information Notice 2003-11, "Leakage Found on Bottom-Mounted Instrumentation Nozzles," describes axially-oriented cracks that were identified in two bottom-mounted instrumentation penetration nozzles at South Texas Project Unit 1 and that the utility concluded that the most likely root cause explanation for the degradation was "manufacturing (welding) flaws resulting in excessive stress in the nozzle/weld material leading to crack initiation with low cycle fatigue/primary water stress corrosion cracking then supporting crack propagation."

To address the part of the RAI 3.1.2.2.7.1-1 which asked for the applicant to provide a basis why the One-Time Inspection Program is justified to manage cracking due to SCC in the stainless steel BMI guide tubes in lieu of crediting a periodic condition monitoring program, the applicant stated that it is crediting the BVPS ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD Program as a periodic condition monitoring program for the bottom-mounted instrumentation guide tubes. The applicant referred to the Enclosure to this letter for the revision to the BVPS LRA. Specifically, the applicant explained that it determined that the BVPS ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD Program is applicable to the bottom-mounted instrumentation guide tubes. The applicant stated that the BVPS LRA, Table 3.1.2-1 is revised to replace row 2, which assigns the One-Time Inspection Program to manage cracking of the bottom-mounted guide tubes, with a row that assigns the ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD Program to manage cracking of the bottom-mounted guide tubes. Further, the applicant stated that based on this change, LRA Table 3.1.1, row 23 and LRA Further Evaluation Section 3.1.2.2.7.1 are revised to identify the assignment of the ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD Program instead of the One-Time Inspection Program to manage cracking of the bottom-mounted guide tubes. The applicant also stated that, LRA Section 3.1.2.1.1, list of assigned programs, is revised to remove the One-Time Inspection Program from the list of aging management programs for the Reactor Vessel System, because there are no other component types in the system that credit the One-Time Inspection Program. The staff verified that the applicant made the applicable amendments of the LRA to credit the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program in Enclosure 1 of the letter of July 21, 2008. The staff finds the amended aging management basis to be acceptable because the BMI guide tubes are stainless steel components that are within the scope of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and because this satisfies the staff's recommendation in SRP-LR Section 3.1.2.2.7, Item (1) to evaluate a plant-specific aging management program is to be evaluated to manage cracking due to SCC in these stainless steel components.

Based on the staff's review of the applicant's response of RAI 3.1.2.2.7.1-1 and the staff's verification of the applicable amendments of the LRA, the staff finds that that the applicant has provided an acceptable basis for managing cracking due to SCC of the BMI guide tubes because: (1) the BMI guide tubes are stainless steel components that are within the scope of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, (2) the applicant has appropriately amended the LRA to credit the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program for management of cracking in these components instead of the One-Time Inspection Program, and (3) this satisfies the staff's recommendation in SRP-LR Section 3.1.2.2.7, Item (1) and GALL AMR IV.A2-1 to evaluate a plant-specific aging management program for management of cracking due to SCC in these stainless steel components. Therefore, the staff's concern in RAI 3.1.2.2.7.1-1 is resolved.

The staff also verified that the RV flange leakage detection lines (tubes) at BVPS are fabricated from nickel-alloy material and that the applicant appropriately aligned its AMR on management of cracking due to SCC in the lines to GALL AMR IV.A2-19. Based on this review, the staff finds that the applicant has a valid basis for not including an AMR item on the RV flange leakage detection tubes that aligns to GALL AMR IV.A2-5. The staff evaluates the applicant's AMRs for the RV flange leakage detection tubes in SER Section 3.1.2.2.13.

Based on the programs identified above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.1.2.2.7.1 to manage cracking due to SCC in the stainless steel BMI guide tubes that are exposed to the reactor coolant, and that for these components, the applicant has met the criteria in SRP-LR Section SRP-LR Section 3.1.2.2.7.1 to manage this aging effect. For those AMR items that apply to LRA Section 3.1.2.2.7.1, the staff concludes that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on this review, the staff also concludes that the applicant has a valid basis for not including an AMR item on the RV flange leakage detection tubes that aligns to GALL AMR IV.A2-5 and that the applicant's AMR basis for the RV flange leakage detections tubes do not need to conform to the guidance in SRP-LR Section 3.1.2.2.7.1 because the RV flange leakage detection lines are not fabricated from stainless steel. The staff evaluates the applicant's AMRs for the nickel-alloy RV flange leakage detection tubes in SER Section 3.1.2.2.13.

<u>Cast Austenitic Stainless Steel (CASS) Reactor Coolant System Components</u>. LRA Section 3.1.2.2.7.2 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.1.2.2.7.2, "Cracking Due to Stress Corrosion Cracking, Cast Austenitic Stainless Steel (CASS) Reactor Coolant System Components," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that cracking due to stress corrosion cracking (SCC) could occur in the BVPS Code Class 1 CASS piping components as a result of exposure to the reactor coolant.

The applicant states that it credits a combination of its Water Chemistry Program and its ASME Section XI, Subsection IWB, IWC, and IWD Program to manage cracking due to SCC in the ASME Code Class 1 CASS piping components as a result of exposure of the components to the reactor coolant.

SRP-LR Section 3.1.2.2.7.2 states that cracking due to SCC could occur in Class 1 PWR cast austenitic stainless steel (CASS) reactor coolant system piping, piping components, and piping elements exposed to reactor coolant. The SRP-LR Section states that, although the existing program relies on control of water chemistry to mitigate SCC, SCC could occur for CASS components that do not meet the NUREG-0313 guidelines with regard to ferrite and carbon content. The SRP-LR Section states that the GALL Report recommends further evaluation of a plant-specific program for these components to ensure that this aging effect is adequately managed.

SRP-LR Section 3.1.2.2.7.2 invokes AMR Item 24 in Table 1 of the GALL Report, Volume 1, and AMR item IV.C2-3, as applicable to the management of cracking due to SCC in ASME Code Class 1 CASS piping, piping components, and piping elements as a result of exposure to the reactor coolant. In these AMR items, the staff recommends that a plant-specific aging management program is to be evaluated to manage cracking due to SCC in these stainless steel components as a result of exposure to the reactor coolant. This is consistent with the guidance in SRP-LR Section 3.1.2.2.7.2.

The staff reviewed LRA Section 3.1.2.2.7.2 and the applicant's AMRs on management of cracking due to SCC in the ASME Code Class 1 CASS piping against the staff's recommended regulatory criteria in SRP-LR Section 3.1.2.2.7.2; AMR Item 24 in Table 1 of the GALL Report, Volume 1; and AMR item IV.C2-3 in the GALL Report, Volume 2.

The staff verified that the applicant does include applicable AMR items in LRA Table 3.1.2-3 that align to the recommendations in GALL AMRs IV.C2-3 on management of cracking due to SCC in the ASME Code Class 1 piping as a result of exposure to the reactor coolant. The staff verified that the applicant credited its Water Chemistry Program and its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to manage cracking due to SCC in these ASME Code Class 1 CASS piping components as a result of exposure of the tubes to the reactor coolant.

The program description in GALL AMP XI.M2, "Water Chemistry," states that water chemistry programs for PWRs rely on monitoring and control of reactor water chemistry based on industry guidelines for primary water and secondary water chemistry such as EPRI TR-105714, Revision 3 and TR-102134, Revision 3 or later revisions. The staff verified that the applicant identifies that its Water Chemistry Program is an AMP that is used for the purpose of controlling the ingress of impurities into the reactor coolant or other plant coolants in order to prevent or mitigate the occurrence of corrosion-based aging effects, such as loss of material due to general, pitting, or crevice corrosion or cracking due to SCC (including PWSCC). The staff also verified that the applicant categorizes its Water Chemistry Program as an AMP that will be consistent with the staff's recommended program element criteria in GALL AMP XI.M2, "Water Chemistry," with enhancement of program elements. Based on this review, the staff determined that the applicant's crediting of its Water Chemistry Program to prevent or mitigate the consequences of cracking due to SCC in the ASME Code Class 1 CASS piping components is valid because the basis for program is in conformance with the program description in GALL AMP XI.M2, Water Chemistry." The staff evaluates the program elements and the capability of the applicant's Water Chemistry Program to prevent or mitigate corrosion-induced aging effects in SER Section 3.0.3.2.14.

The program description in GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWC," states that ASME Section XI inservice inspection (ISI) programs, implemented in accordance with the requirements in 10 CFR 50.55a and the ASME Code Section XI, Subsections IWB, IWC, or IWD has been shown to be generally effective in managing aging effects in ASME Code Class 1, 2, or 3 components and their integral attachments. The program description states that, in certain cases, the ASME ISI program should be augmented to manage effects of aging for license renewal and that the GALL Report identifies those components in which augmentation of the AMP is necessary for aging management.

The CASS piping components within the scope of applicant's AMR are ASME Code Class 1 piping components that are part of the RCPB. The staff verified that the applicant identifies its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program as a condition monitoring program for ASME Code Class 1, 2, and 3 pressure-retaining components, including welds, pump casings, valve bodies, integral attachments, and pressure-retaining bolting. The staff also verified that the applicant categorizes its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program as an AMP that is consistent with the staff's recommended program element criteria in GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," with an exception. Based on this review, the staff concluded that it is valid for the applicant's to credit its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program for management of cracking due to SCC in the ASME Code Class 1 CASS piping components because the basis for program management is in conformance with the program description in GALL AMP XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The staff evaluates the program elements and the capability of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to cracking due to SCC in the ASME Code Class 1 CASS piping in SER Section 3.0.3.2.1.

Based on this review, the staff finds that the applicant has included appropriate AMR items on management of cracking due to SCC in the ASME Code Class 1 CASS piping components that align to GALL AMR Item 24 in Table 1 of the GALL Report, Volume 1 and to AMR item IV.C2-3 in the GALL Report, Volume 2. The staff also finds that the applicant has evaluated applicable plant-specific programs and has provided a valid basis for crediting the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program credited valid AMPs to manage cracking due to SCC in the ASME Code Class 1 CASS piping.

Based on the programs identified above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.1.2.2.7.2 to manage cracking due to SCC in the ASME Code Class 1 CASS piping components that are exposed to the reactor coolant, and that for these components, the applicant has met the criteria in SRP-LR Section SRP-LR Section 3.1.2.2.7.2 to manage this aging effect. For those AMR items that apply to LRA Section 3.1.2.2.7.2, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.8 Cracking Due to Cyclic Loading

BWR Jet Pump Sensing Lines Under Exposure to the Reactor Coolant. SRP-LR Section 3.1.2.2.8, Item (1) states that cracking due to cyclic loading could occur in the stainless steel BWR jet pump sensing lines under exposure to the reactor coolant. The SRP-LR Section states that the GALL Report recommends that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed, and that acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

For the BWR components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 25 in Table 1 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item IV.B1-12 in Table IV.B1 of the GALL Report, Revision 1, Volume 2 (GALL2). The applicant identified that the BVPS units are PWR-designed and concluded that the guidance for these BWR components are not applicable to the BVPS LRA. Thus, based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.1.2.2.2, Item (1) and the referenced GALL AMRs is not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR components and because the BVPS units are Westinghouse-designed PWR reactors.

BWR Isolation Condenser Components Under Exposure to the Reactor Coolant. SRP-LR Section 3.1.2.2.8, Item (2) states that cracking due to cyclic loading could occur in steel and stainless steel BWR isolation condenser components under exposure to the reactor coolant. The SRP-LR Section states that the existing program relies on ASME Section XI ISI, but qualifies this statement by clarifying that the existing program should be augmented to detect cracking due to cyclic loading. The SRP-LR Section states that the GALL Report recommends that existing program be augmented to include temperature and radioactivity monitoring of the shell-side water, and eddy current testing of the isolation condenser tubes to ensure that the component's intended function will be maintained during the period of extended operation. The SRP-LR Section states that acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

For the BWR isolation condenser components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 26 in Table 1 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item IV.C1-5 in Table IV.C1 of the GALL Report, Revision 1, Volume 2 (GALL2). The applicant identified that the BVPS units are PWR-designed and concluded the guidance for these BWR components are not applicable to the BVPS LRA. Thus, based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.1.2.2.2, Item (2) and the referenced GALL AMRs is not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR components and because the BVPS units are Westinghouse-designed PWR reactors.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

LRA Section 3.1.2.2.9 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.1.2.2.9, "Loss of Preload Due to Stress Relaxation," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that loss of preload due to stress relaxation could occur in the reactor vessel internal (RVI) bolts and springs made from stainless steel or nickel-alloy materials. The applicant identifies that the applicable components are the upper internals assembly hold-down springs and the core baffle/former bolting, and bolting associated with the RCCA guide tube assembly, lower internals assembly, and core barrel assembly.

The applicant states that it credits its commitments for PWR RVI components to manage loss of preload due to stress relaxation in nickel-alloy and stainless steel RVI bolts and springs and includes these commitments in Commitment No. 18 of Unit 1 UFSAR Supplement Table A4-1 and Commitment No. 20 of Unit 2 UFSAR Supplement Table A5-1, as follows:

(1) Participate in the industry programs applicable to BVPS Unit 1/Unit 2 for investigating and managing aging effects on reactor internals;

(2) Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1/Unit 2 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 the BVPS Unit 1/Unit 2 reactor internals to the NRC for review and approval."

SRP-LR Section 3.1.2.2.9 states that loss of preload due to stress relaxation could occur in stainless steel and nickel-alloy PWR reactor vessel internals screws, bolts, tie rods, and hold-down springs exposed to reactor coolant. The SRP-LR Section states that the GALL Report recommends no further aging management review if the applicant provides a commitment in the FSAR 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."

For RVI components in Westinghouse-designed PWRs, SRP-LR Section 3.1.2.2.9 invokes AMR Item 27 in Table 1 of the GALL Report, Volume 1, and AMR items IV.B2-5, IV.B2-14, IV.B2-25, IV.B2-33, and IV.B2-38 in the GALL Report Volume 2, as applicable to the management of loss of preload due to stress relaxation in baffle/former bolts, lower internals assembly clevis insert bolts, lower core plate bolts in the lower internals assembly, upper internals assembly hold-down springs, and upper support column bolts in the upper internals assembly as a result of exposure the components to the reactor coolant. In these GALL AMRs, the staff states that no aging management is necessary if the applicant incorporates a commitment on UFSAR supplement to: "(1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval." This is consistent with the guidance in SRP-LR Section 3.1.2.2.9.

The staff reviewed LRA Section 3.1.2.2.9 and the applicant's AMRs of management of loss of preload due to stress relaxation in the BVPS RVI bolts and springs against the staff's recommended regulatory criteria in SRP-LR Section 3.1.2.2.9; AMR Item 27 in Table 1 of the GALL Report, Volume 1; and AMR items IV.B2-5, IV.B2-14, IV.B2-25, IV.B2-33, and IV.B2-38 in the GALL Report, Volume 2.

The staff verified that the applicant does include applicable AMR items in LRA Table 3.1.2-2 that align to and conform with the recommendations in GALL AMRs IV.B2-5, IV.B2-14, IV.B2-25, IV.B2-33, and IV.B2-38 for the baffle/former bolts, lower internals assembly clevis insert bolts, lower core plate bolts in the lower internals assembly, upper internals assembly hold-down springs, and upper support column bolts at BVPS that are made from either stainless steel or nickel-alloy materials and are exposed to the reactor coolant, and in some cases to an integrated neutron flux in excess of 1.0×10^{17} n/cm^2 ($E \geq 1.0$ MeV).

The staff also verified that applicant has conservatively aligned its AMR on loss of preload due to stress relaxation in the stainless steel core barrel assembly bolts to GALL AMR IV.B2-5 because the applicant has determined that the material of fabrication, environment, and aging effect for core barrel assembly bolts are the same as those that the applicant has identified for the core baffle/former bolts (i.e., all of these bolts have a material-environment-aging effect combination of stainless steel-reactor coolant and neutron flux-loss of material due to stress relaxation). The staff finds that this is acceptable because it is in conformance with Footnote C Type “2” AMRs, as provided in the latest edition of the license renewal guidelines in NEI Report NEI-95-10, Revision 6 [June 15, 2005], and which was endorsed by the NRC in NUREG-1.188, Revision 1 [September 2005].

For these nickel-alloy or stainless steel RVI bolt or spring commodity groups, the staff verified that the applicant credits its commitments for PWR RVI components to manage loss of preload due to stress relaxation in the nickel-alloy and stainless steel RVI components, as follows:

> “For the PWR Vessel Internals Program, regarding activities for managing the aging of Reactor Vessel internal components and structures, BVPS commits to:
>
> (1) Participate in the industry programs applicable to BVPS Unit 1/Unit 2 for investigating and managing aging effects on reactor internals;
>
> (2) Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1/Unit 2 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 the BVPS Unit 1/Unit 2 reactor internals to the NRC for review and approval.”

The staff verified that the applicant includes this commitment in Commitment No. 18 of LRA UFSAR Supplement Table A.4-1 for BVPS Unit 1 and in Commitment No. 20 of LRA UFSAR Supplement Table A.5-1 for BVPS Unit 2. As a result as this review, the staff finds that the applicant has credited an acceptable AMR basis to manage loss of preload due to stress relaxation in the RVI bolts and springs of the upper internals assemblies, baffle/former assemblies, core barrel assemblies, and lower internals assemblies because the commitments credited to further evaluate these components, and to manage loss of preload due to stress relaxation in the components, have been verified to be in conformance with the staff’s recommended criteria in SRP-LR Section 3.1.2.2.9 and the GALL AMRs that are invoked by this SRP-LR section.

Based on the commitments identified and discussed above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.1.2.2.9 to loss of preload due to stress relaxation in the RVI bolts and springs of the upper internals assemblies, baffle/former assemblies, core barrel assemblies, and lower internals assemblies, and that for these components, the applicant has met the criteria in SRP-LR Section 3.1.2.2.9 to manage this aging effect. 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 the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.10 Loss of Material Due to Erosion

SRP-LR Section 3.1.2.2.10 states that loss of material due to erosion could occur in steel steam generator (SG) feedwater impingement plates and supports exposed to secondary feedwater.

The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

For the PWR SG components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 28 in Table 1 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item IV.D1-13 in Table IV.B1 of the GALL Report, Revision 1, Volume 2 (GALL2), as applicable to the management of loss of material by erosion in the SG impingement plates and supports of once-through SGs.

The applicant stated in LRA Section 3.1.2.2.10 that BVPS does not have impingement plates. Further, the applicant stated that other SG support components that are susceptible to erosion are aligned to LRA AMR 3.1.1-76 and to AMR Item IV.D1-9 in Table IV.D1 of the GALL Report Volume 2 (GALL AMR IV.D1-9 and loss of material due to erosion of these components is managed by a combination of the Water Chemistry and Steam Generator Tubing Integrity programs.

The staff noted that the AMR item in the GALL Report, Volume 2 pertaining to SRP-LR Section 3.1.2.2.10 is GALL AMR IV.D1-13 for steel SG feedwater impingement plates and supports exposed to secondary feedwater. The staff reviewed the AMR line items for SG components listed in LRA Table 3.1.2-3 and verified that the table did not include any AMRs for SG components that aligned to LRA AMR Item 3.1.1-28 or to GALL AMR IV-D1-13. The staff reviewed all the other AMR line items for the SG components and verified that those SG components subject to erosion have been aligned to 3.1.1-76 instead of 3.1.1-28. Further, the staff reviewed the LRA and the UFSAR for BVPS and verified that the SG designs at BVPS do not include SG impingement plates. Therefore, based on this review, the staff concludes that the guidance in SRP-LR Section 3.1.2.2.10 is not applicable to the BVPS LRA because the BVPS Unit 1 and Unit 2 SG designs do not include SG impingement plates. The staff's evaluation of the applicant's AMR items on loss of material due to erosion in other SG components is given in SER Section 3.1.2.1.

3.1.2.2.11 Cracking Due to Flow-Induced Vibration

SRP-LR Section 3.1.2.2.11 states that cracking due to flow-induced vibrations could occur in the stainless steel BWR steam dryers under exposure to the reactor coolant. The SRP-LR Section states that the GALL Report recommends that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed, and that acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR).

For the BWR components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 29 in Table 1 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item IV.B1-16 in Table IV.B1 of the GALL Report, Revision 1, Volume 2 (GALL2). The applicant identified that the BVPS units are PWR-designed and concluded that the guidance for these BWR components are not applicable to the BVPS LRA. Thus, based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.1.2.2.11 and the referenced GALL AMRs are not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR steam dryer components and because the BVPS units are Westinghouse-designed PWR reactors.

3.1.2.2.12 Cracking Due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking

LRA Section 3.1.2.2.12 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.1.2.2.12, "Cracking Due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking (IASCC)," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that cracking due to stress corrosion cracking (SCC) or irradiation-assisted stress corrosion cracking (IASCC, a form of SCC) could occur in the reactor vessel internal (RVI) components made from stainless steel materials.

The applicant states that it credits its commitments for PWR RVI components to manage cracking due to SCC or IASCC in the stainless steel RVI components and includes these commitments in Commitment No. 18 of Unit 1 UFSAR Supplement Table A4-1 and Commitment No. 20 of Unit 2 UFSAR Supplement Table A5-1, as follows:

(1) Participate in the industry programs applicable to BVPS Unit 1/Unit 2 for investigating and managing aging effects on reactor internals;

(2) Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1/Unit 2 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 the BVPS Unit 1/Unit 2 reactor internals to the NRC for review and approval."

SRP-LR Section 3.1.2.2.12 provides the following guidance on aging management of cracking due to SCC or IASCC in RVI components that are made from stainless steel materials:

> "Cracking due to SCC and IASCC could occur in PWR stainless steel reactor internals exposed to reactor coolant. The existing program relies on control of water chemistry to mitigate these effects. The GALL Report recommends no further aging management review if the applicant provides a commitment in the FSAR 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."

For RVI components in Westinghouse-designed PWRs, SRP-LR Section 3.1.2.2.12 invokes AMR Item 30 in Table 1 of the GALL Report, Volume 1, and AMR items IV.B2-2, IV.B2-8, IV.B2-10, IV.B2-12, IV.B2-24, IV.B2-30, and IV.B2-36, and IV.B2-42 in the GALL Report, Volume 2, as applicable to the management of cracking due to SCC or IASCC in baffle/former plates; core barrel (CB), CB flange, CB outlet nozzles, and thermal shield; flux thimble guide tubes; lower support casting/forging and lower support plate columns in the lower internal assembly; RCCA guide tubes in the RCCA guide tube assembly; upper support columns in the upper internals assembly; and upper support plates, upper core plates, and hold-down springs in upper internals assembly as a result of exposure the components to the reactor coolant. In these GALL AMRs, the staff states that no aging management is necessary if the applicant incorporates a commitment on UFSAR supplement to: "(1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval." This is consistent with the guidance in SRP-LR Section 3.1.2.2.12.

The staff reviewed LRA Section 3.1.2.2.12 and the applicant's AMRs of management of cracking due to SCC and IASSC in specific BVPS RVI components against the staff's recommended regulatory criteria in SRP-LR Section 3.1.2.2.12; AMR Item 30 in Table 1 of the GALL Report, Volume 1; and AMR items IV.B2-2, IV.B2-8, IV.B2-10, IV.B2-12, IV.B2-24, IV.B2-30, and IV.B2-36, and IV.B2-42 in the GALL Report, Volume 2.

The staff verified that the applicant does include applicable AMR items in LRA Table 3.1.2-2 that align to and conform with the recommendations in GALL AMRs AMR items IV.B2-2, IV.B2-8, IV.B2-10, IV.B2-12, IV.B2-24, IV.B2-30, and IV.B2-36, and IV.B2-42 to manage cracking due to SCC or IASCC in the stainless steel (including CASS) baffle/former plates; core barrel (CB), CB flange, CB outlet nozzles, and thermal shield; flux thimble guide tubes; lower support casting or forging and lower support plate columns in the lower internal assembly; RCCA guide tubes in the RCCA guide tube assembly; upper support column in the upper internals assembly; and upper support plate, upper core plate, and hold-down spring in upper internals assembly as a result of exposing the components to the reactor coolant, and for some of these components to an integrated neutron flux.

The staff also verified that applicant has conservatively aligned its AMRs on cracking due to SCC or IASCC in the following additional stainless steel RVI components to either GALL AMR IV.B2-8, IV.B2-12, IV.B2-24, or IV.B2-42:

- core barrel assembly bolts (aligning to GALL AMR IV.B2-8)
- thermocouple conduits in the instrumentation support structures (aligning to GALL AMR IV.B2-12)
- secondary core support, head vessel alignment pin, and head cooling spray nozzles in the lower internals assemblies (aligning to GALL AMR IV.B2-24)
- upper core plates, upper support plate and support assemblies in the upper internals assemblies (aligning to GALL AMR IV.B2-42)

The staff finds this to be acceptable because the applicant has determined that the material of fabrication, environment, and aging effect for the components are the same as those identified for the commodity groups addressed in the respective GALL AMRs and because it is in conformance with Footnote C Type "2" AMRs, as provided in the latest edition of the license renewal guidelines in NEI Report #NEI-95-10, Revision 6 [June 15, 2005], and which was endorsed by the NRC in NUREG-1.188, Revision 1 [September 2005].

For these stainless steel, CASS, or nickel-alloy RVI components, the staff verified that the applicant credits its commitments for PWR RVI components to manage cracking due to SCC or IASCC, as follows:

"For the PWR Vessel Internals Program, regarding activities for managing the aging of Reactor Vessel internal components and structures, BVPS commits to:

(1) Participate in the industry programs applicable to BVPS Unit 1/Unit 2 for investigating and managing aging effects on reactor internals;

(2) Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1/Unit 2 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 the BVPS Unit 1/Unit 2 reactor internals to the NRC for review and approval."

The staff verified that the applicant includes this commitment in Commitment No. 18 of LRA UFSAR Supplement Table A.4-1 for BVPS Unit 1 and in Commitment No. 20 of LRA UFSAR Supplement Table A.5-1 for BVPS Unit 2. As a result as this review, the staff finds that the applicant has credited an acceptable AMR basis to manage cracking due to SCC or IASCC in the stated core/former assembly, lower internals assembly, core barrel assembly, upper internals assembly, and instrumentation support structure components because the commitments credited to further evaluate these components, and to manage cracking due to SCC or IASCC in the components, have been verified to be in conformance with the staff's recommended criteria in SRP-LR Section 3.1.2.2.12 and the GALL AMRs that are invoked by this SRP-LR section.

Based on the commitments identified and discussed above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.1.2.2.12 to manage cracking due to SCC or IASCC in the stated core/former assembly, lower internals assembly, core barrel assembly, upper internals assembly, and instrumentation support structure components, and that for these components, the applicant has met the criteria in SRP-LR Section SRP-LR Section 3.1.2.2.12 to manage this aging effect. 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 the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.13 Cracking Due to Primary Water Stress Corrosion Cracking

LRA Section 3.1.2.2.13 addresses the applicant's evaluation that on whether the recommended guidance in SRP-LR Section 3.1.2.2.13, "Cracking due to Primary Water Stress Corrosion Cracking," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states the design of the BVPS reactor coolant system includes nickel-alloy components and steel components that are designed with internal nickel-alloy cladding that are exposed internal to the borated treated water environment. The applicant clarifies that these components include nickel-alloy reactor coolant pressure boundary (RCPB) components, including pressurizer heater sheaths and sleeves, pressurizer safe end welds, bottom mounted instrumentation (BMI) tubes, steam generator (SG) drain tubes, reactor vessel nozzle safe end welds, and other internal nickel-alloy components. In this section, the applicant identifies that cracking due to primary water stress corrosion cracking (PWSCC) is an applicable aging effect requiring management for the nickel-alloy components surfaces that are exposed to the treated borated treated water environment of the reactor coolant.

The applicant states that it credits a combination of the Water Chemistry Program and the applicant's ASME Section XI, Subsections IWB, IWC, and IWD to manage cracking due to PWSCC in these components. The applicant also stated that, additionally, it credits its commitment for nickel-Alloy components to manage cracking due to PWSCC in these components, and includes this commitment Commitment No. 15 of LRA UFSAR Supplement Table A.4-1 for BVPS Unit 1 and in Commitment No. 17 of LRA UFSAR Supplement Table A.5-1 for BVPS Unit 2, as follows:

> "For the Nickel-Alloy Nozzles and Penetrations Program, regarding activities for managing the aging of nickel-alloy components and nickel-alloy clad components susceptible to primary water stress corrosion cracking - PWSCC (other than upper reactor vessel closure head nozzles and penetrations), BVPS commits to develop a plant-specific aging management program that will implement applicable:
>
> 1. NRC Orders, Bulletins and Generic Letters; and,
> 2. Staff-accepted industry guidelines."

SRP-LR Section 3.1.2.2.13 provides the following guidance on whether or not an applicant for license renewal needs to perform additional evaluations of its nickel-alloy in order to manage cracking due to PWSCC:

> "For cracking due to PWSCC of PWR components (with the exception of reactor vessel upper head nozzles and penetrations) made of nickel-alloy or having nickel-alloy cladding, the GALL Report recommends no further aging management review if the applicant complies with applicable NRC Orders and provides a commitment in the FSAR Supplement to implement applicable (1) Bulletins and Generic Letters associated with nickel-alloys and (2) staff-accepted industry guidelines."

For applicable nickel-alloy components in PWRs with recirculation steam generators, SRP-LR Section 3.3.2.2.13 invokes AMR Item 31 in Table 1 of the GALL Report, Volume 1, and GALL AMR items IV.A2-12, IV.A2-19, IV.C2-13, IV.C2-21, IV.C2-24, IV.D1-4, as applicable to the management of cracking due to PWSCC in nickel-alloy core support pads/lugs; BMI tubes; piping, piping components, and piping components; pressurizer instrumentation penetrations, heater sheaths and sleeves, heater bundle diaphragm plate, and manways and flanges; pressurizer surge and steam space nozzles and welds; and recirculating SG instrument penetrations and primary side nozzles, safe ends, and welds, respectively.

In these GALL AMRs, the staff recommends that the management of cracking due to PWSCC be managed using a combination of the applicant's Water Chemistry Program and the applicant's ASME Section XI, Subsection IWB, IWC, and IWD Program. The staff also recommends that, as an additional measure to manage cracking due to PWSCC, the applicant place a commitment on the UFSAR Supplement for the LRA to comply with applicable NRC Orders, Bulletins, and Generic Letters on PWSCC of nickel-alloy components and with staff-accepted industry guidelines. This is consistent with the guidance in SRP-LR Section 3.3.2.2.13.

The staff reviewed LRA Section 3.1.2.2.13 and the applicant's AMRs for its nickel-alloy components in the RCPB against the staff's recommended regulatory criteria in SRP-LR Section 3.3.2.2.13; AMR Item 31 in Table 1 of the GALL Report, Volume 1; and AMR items IV.A2-12, IV.A2-19, IV.C2-13, IV.C2-21, IV.C2-24, IV.D1-4 in the GALL Report, Volume 2.

The staff verified that the applicant does include applicable AMR lines items in the LRA Table 3.1.2-1 and 3.1.2-3 that align to the recommendations in AMRs IV.A2-12, IV.A2-19, IV.C2-13, IV.C2-24, IV.D1-4 of the GALL Report, Volume 2, for the following nickel-alloy RCPB components:

- Reactor vessel (RV) core support pads/lugs (aligning to GALL AMR IV.A2-12)
- BMI penetration nozzles/tubes (aligning to GALL AMR IV.A2-19)
- RV inlet/outlet nozzle safe end welds (for BVPS unit 2 only, aligning to GALL AMR IV.C2-13)
- Pressurizer safe-end welds (aligning to GALL AMR IV.C2-24)
- SG primary safe-end welds (aligning to GALL AMR IV.D1-4)

The staff verified that the applicant has aligned the following additional AMRs on nickel-alloy component cracking to either GALL AMR IV.A2-19, IV.C2-21, of IV.D1-4:

- Nickel-alloy RV flange leakage detection tubes (aligning to GALL AMR IV.A2-19)
- BVPS Unit 2 nickel-alloy flexible hose (aligning to GALL AMR IV.C2-21)
- Steel SG tubesheets designed with nickel-alloy cladding (aligning to GALL AMR IV.D1-4)
- BVPS Unit 2 nickel-alloy SG drain tube (aligning to GALL AMR IV.D1-4)

For the nickel-alloy component commodity groups in these AMRs, the applicant conservatively credits its ASME Section XI, Subsection IWB, IWC, and IWD Program and its Water Chemistry Program to manage cracking due to PWSCC for the surfaces that are exposed to the borated treated water environment. The staff has verified that the applicant also credits its commitments for nickel-alloy components as an additional basis for managing cracking due to PWSCC, as follows:

> "For the Nickel-Alloy Nozzles and Penetrations Program, regarding activities for managing the aging of nickel-alloy components and nickel-alloy clad components susceptible to primary water stress corrosion cracking - PWSCC (other than upper reactor vessel closure head nozzles and penetrations), BVPS commits to develop a plant-specific aging management program that will implement applicable:
>
> 1. NRC Orders, Bulletins and Generic Letters; and,
> 2. Staff-accepted industry guidelines."

The staff verified that the applicant includes this commitment in Commitment No. 15 of LRA UFSAR Supplement Table A.4-1 for BVPS Unit 1 and in Commitment No. 17 of LRA UFSAR Supplement Table A.5-1 for BVPS Unit 2.

Based on this review, the staff determined that the programs and commitments credited by the applicant for its nickel-alloy Class 1 components are in conformance with the staff's recommended criteria in SRP-LR Section 3.1.2.2.13; AMR Item 31 in Table 1 of the GALL Report, Volume 1, and GALL AMR items IV.A2-12, IV.A2-19, IV.C2-13, IV.C2-21, IV.C2-24, IV.D1-4, and are acceptable.

The staff has verified that the RV inlet/outlet nozzle safe-end welds at BVPS Unit 1 are fabricated from stainless steel welds. Therefore, the staff concludes that the LRA does not need to include an AMR in the LRA that aligns to GALL AMR IV.C2-13 for the RV inlet/outlet nozzle safe-end welds at BVPS Unit 1. The staff has verified that the applicant's AMRs for the stainless steel RV inlet/outlet nozzle safe-end welds at BVPS Unit 1 appropriately align to and are entirely consistent with the staff recommendations in GALL AMR IV.A2-15. The staff has evaluated these AMR items in SER Section 3.1.2.1 as AMR items that have been verified to be entirely consistent with the GALL Report.

The staff noted that WCAP-15474-A, "License Renewal Evaluation: Aging Management Evaluation for Pressurizers", as approved in the staff's safety evaluation of October 26, 2000, provides the generic basis the Westinghouse designed PWRs (including the BVPS units). In this report, Westinghouse Electric Corporation (WEC) identifies that the nickel-alloy locations in Westinghouse-designed pressurizers are those for the safe end welds for the pressurizer safety, relief, spray and surge nozzles. The staff noted that the AMRs for these safe-end welds align to GALL AMR IV.C2-24. The staff also noted that AMR IV.C2-21 in the GALL Report, Volume 2 provides the staff's AMR recommendations for managing cracking due to pressurized water stress corrosion cracking pressurizer instrumentation penetrations, heater sheaths and sleeves, heater bundle diaphragm plate, and manways and flanges that are fabricated from nickel-alloy materials or are designed with internal nickel-alloy cladding. In RAI 3.1.2.2.13-1, the staff asked the applicant to clarify whether or not the pressurizer instrumentation penetrations, heater sheaths and sleeves, heater bundle diaphragm plate, and manways and flanges that are fabricated from nickel-alloy materials or are designed with internal nickel-alloy cladding.

The applicant responded to RAI 3.1.2.2.13-1 in a letter dated July 21, 2008. In this response, the applicant clarified that the only nickel-alloy components in the BVPS pressurizers are the safe ends welds for the BVPS Unit 1 and Unit 2 pressurizer spray nozzles, relief nozzles, and safety nozzles, and the safe end weld for the BVPS Unit 2 pressurizer surge line nozzle. The applicant clarified that the AMRs for these nozzle safe end welds have been aligned to GALL AMR IV.C2-4. The staff reviewed WCAP-15474-A, "License Renewal Evaluation: Aging Management Evaluation for Pressurizers," and verified that the report confirms that the pressurizer spray nozzle, relief nozzle, and safety nozzle safe end welds at BVPS Unit 1 and Unit 2 and the presssurizer surge nozzle safe- end weld at BVPS Unit 2 are fabricated from nickel-alloy filler welds. The staff verified that the applicant aligned its AMRs for these nickel-alloy safe-end welds to GALL AMR IV.C2-24 and that in these AMRs, the applicant credited its Water Chemistry Program, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, and commitments for nickel-alloy components to manage cracking due to PWSCC in the nickel-alloy welds. The staff finds this to be acceptable because in is in conformance with the staff's recommendations in GALL AMR IV.C2-24 and SRP-LR Section 3.1.2.2.13.

The staff verified that WCAP-14574-NP-A does not identify Westinghouse-design pressurizer instrumentation penetrations, heater sheaths and sleeves, heater bundle diaphragm plates, and manways and flanges as pressurizer components that fabricated from nickel-alloy base metal materials or that are designed with nickel-alloy filler welds or internal nickel-alloy cladding Based on this review, staff verified that the applicant does not need to include any AMR items in the LRA aligning to AMR IV.C2-21 in the GALL Report, Volume 2, on management of cracking due to PWSCC in pressurizer instrumentation penetrations, heater sheaths and sleeves, heater bundle diaphragm plate, and manways and flanges because the staff has verified that the BVPS design does not include these components or that the design of these components at BVPS does not include nickel-alloy materials or nickel-alloy cladding and instead that the applicant manages cracking in these components through AMRs that align to either GALL AMR IV.C2-19 or IV.C2-20. The staff evaluates these AMR in SER Section 3.1.2.1 as AMR items that have been verified to be entirely consistent with the GALL Report. RAI 3.1.2.2.13 is resolved.

Based on this review, the staff concludes that the programs and commitments credited by the applicant for its nickel-alloy Class 1 components are acceptable because they are in conformance with the staff's recommended aging management criteria in SRP-LR Section 3.1.2.2.13; AMR Item 31 in Table 1 of the GALL Report, Volume 1, and in GALL AMR item IV.A2-12, IV.A2-19, IV.C2-13, IV.C2-21, IV.C2-24, or IV.D1-4.

The staff also concludes that the applicant does not need to include an AMR item aligning to GALL AMR IV.C2-13 for the nickel-alloy RV inlet/outlet nozzles and their associated safe-end welds at BVPS Unit 1 because the nozzles and associated safe-end welds are not fabricated from nickel-alloy materials. Instead, the staff has verified that the applicant's AMR for managing cracking in the stainless steel RV inlet/outlet nozzle safe-end welds at BVPS Unit 1 appropriately aligns to and is entirely consistent with the staff recommendations in GALL AMR IV.A2-15.

The staff also concludes that the applicant does not need to include any AMR items aligning to AMR IV.C2-21 in the GALL Report, Volume 2, on management of cracking due to PWSCC in pressurizer instrumentation penetrations, heater sheaths and sleeves, heater bundle diaphragm plate, and manways and flanges because the staff has verified that the BVPS design does not include these components or that the design of these components at BVPS does not include nickel-alloy materials or nickel-alloy cladding. Instead, the staff has verified that the applicant's AMR for managing cracking in the stainless steel components accomplished through AMRs that align to and are entirely consistent with the staff's recommendations in either GALL AMR IV.C2-19 or GALL AMR IV.C2-20.

Based on the programs identified above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.1.2.2.13 to manage cracking due to PWSCC in the Class 1 nickel-alloy components that are exposed to the borated treated water environment of the reactor coolant, and that for these components, the applicant has met the criteria in SRP-LR Section SRP-LR Section 3.1.2.2.13 to manage this aging effect. For those AMR items that apply to LRA Section 3.1.2.2.13, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.14 Wall Thinning Due to Flow-Accelerated Corrosion

LRA Section 3.1.2.2.14 states that wall thinning due to flow-accelerated corrosion (loss of material due to FAC) could occur in steam generator (SG) feedwater inlet rings and supports.

SRP-LR Section 3.1.2.2.14 states that loss of material due to FAC could occur in steam generator feedwater inlet rings (feedrings) and supports. The SRP-LR Section and the AMR items in the GALL Report that are based on this SRP-LR Section reference NRC IN 91-19, "Steam Generator Feedwater Distribution Piping Damage," for monitoring for evidence of FAC in SG components. In this SRP-LR section, the staff recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting loss of material due to FAC.

The staff noted that the GALL AMR that is based on the recommendations of SRP-Section 3.1.2.2.14 is AMR Item IV.D1-26 and that in this AMR, the staff recommends that an AMP be evaluated to manage loss of material due to FAC in recirculating SG feedwater rings and their supports. The staff noted that the applicant credited its One-Time Inspection Program (Section B.2.30) as the plant-specific AMP for managing loss of material due to FAC of the SG feedwater rings.

GALL AMP XI.M32 states that one-time inspection programs are appropriate to use for cases where:

> (a) an aging effect is not expected to occur but the data is insufficient to rule it out with reasonable confidence; (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected; or (c) the characteristics of the aging effect include a long incubation period.

The staff noted that in the LRA, the applicant identifies its One-Time Inspection Program as a program that is consistent with the staff's recommendations in GALL AMP XI.M32, "One-Time Inspection," and that the program is credited as a condition monitoring program that is used to confirm the effectiveness of a preventative or mitigative type AMP (such as the Water Chemistry Program) or to verify whether an aging effect is occurring if the aging effect is not expected or if the growth of the aging effect is expected to occur at a very slow rate. The staff also verified that the applicant's One-Time Inspection Program includes the SG feedrings.

The staff noted, however, that the applicant did not clarify in LRA Section 3.1.2.2.14 whether loss of material due to FAC is anticipated to occur in the SG feedrings or supports, or if it is, whether the progression of FAC in the components would only occur at an extremely slow growth rate. As a result, the staff noted that Section 3.1.2.2.14 of the LRA did not provide adequate justification for crediting the One-Time Inspection as the aging management basis in lieu of proposing to use a periodic condition monitoring program for aging management of loss of material due to FAC. In its LRA update dated December 19, 2008, the applicant amended LRA Section 3.1.2.2.14 to provide additional justification on why it is acceptable to credit its One-Time Inspection Program to manage FAC in these SG feedrings and supports. In this letter, the applicant clarified that there has not been any FAC detected in the SG feedrings and supports during inspections that were performed in response to the event identified in IN 91-19 and that as a result of this, the One-Time Inspection Program is a valid program to credit to verify that FAC is not occurring in these components or if it is, that it is progressing a very slow rate. GALL AMP XI.M32, “One-Time Inspection states that applicant’s may credit One-time Inspection Programs for cases where: (1) an aging effect is not expected to occur but the data is insufficient to rule it out with reasonable confidence; (2) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected; (3) the characteristics of the aging effect include a long incubation period; or (4) provide additional assurance that aging that has not yet manifested itself is not occurring, or that the evidence of aging shows that the aging is so insignificant that an aging management program is not warranted. Based on this review, the staff finds the applicant’s amended basis to be acceptable because it is consistent with statement in GALL AMP XI.M32, “One-Time Inspection,” on when it is appropriate to credit One-time Inspection Programs for aging management.

Based on the programs identified above, the staff concludes that the applicant’s programs meet SRP-LR Section 3.1.2.2.14 criteria. For those line items that apply to LRA Section 3.1.2.2.14, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.15 Changes in Dimensions Due to Void Swelling

LRA Section 3.1.2.2.15 addresses the applicant’s evaluation on whether the recommended guidance in SRP-LR Section 3.1.2.2.12, “Changes in Dimensions Due to Void Swelling,” is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that changes in dimensions could occur in the reactor vessel internal (RVI) components made from stainless steel (including cast austenitic stainless steel [CASS]) and nickel-alloy materials as a result of void swelling.

The applicant states that it credits its commitments for the PWR RVI components to manage changes in dimensions of stainless steel, CASS, and nickel-alloy RVI components as a result of void swelling and includes these commitments in Commitment No. 18 of Unit 1 UFSAR Supplement Table A4-1 and Commitment No. 20 of Unit 2 UFSAR Supplement Table A5-1, as follows:

(1) Participate in the industry programs applicable to BVPS Unit 1/Unit 2 for investigating and managing aging effects on reactor internals;

(2) Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1/Unit 2 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 the BVPS Unit 1/Unit 2 reactor internals to the NRC for review and approval.”

SRP-LR Section 3.1.2.2.15 provides the following guidance on aging management of changes in dimensions in stainless steel, CASS, or nickel-alloy PWR RVI components as a result of void swelling:

> "Changes in dimensions due to void swelling could occur in stainless steel and nickel-alloy PWR reactor internal components exposed to reactor coolant. The GALL Report recommends no further aging management review if the applicant provides a commitment in the FSAR 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."

For RVI components in Westinghouse-designed PWRs, SRP-LR Section 3.1.2.2.15 invokes AMR Item 33 in Table 1 of the GALL Report, Volume 1, and AMR items IV.B2-1, IV.B2-4, IV.B2-7, IV.B2-11, IV.B2-15, IV.B2-19, IV.B2-23, IV.B2-27, IV.B2-29, IV.B2-35, IV.B2-39, and IV.B2-41 in the GALL Report, Volume 2, as applicable to the management of changes in dimension due to void swelling in baffle/former assembly plates; baffle/former assembly bolts; core barrel (CB), CB flange, CB outlet nozzles, and thermal shield; flux thimble guide tubes in the instrument support structure; fuel alignment pins, lower support plate column bolts, and clevis insert bolts in the lower internals assembly; lower core plates and radial keys and clevis inserts in the lower internals assembly; lower support castings/forgings and lower support plate columns in the lower internals assembly; RCCA guide tube bolts and support pins in the RCCS guide tube assembly; RCCA guide tubes in the RCCA guide tube assembly; upper support columns in the upper internals assembly; upper support column bolts, upper core plate alignment pins, and fuel alignment pins in the upper internals assembly; and upper support plate, upper core plate, and hold-down springs in the upper internals assembly. In these GALL AMRs, the staff states that no aging management is necessary if the applicant incorporates a commitment on UFSAR supplement to: "(1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval." This is consistent with the guidance in SRP-LR Section 3.1.2.2.15.

The staff reviewed LRA Section 3.1.2.2.15 and the applicant's AMRs of management of changes in dimensions due to void swelling of specific BVPS RVI components against the staff's recommended regulatory criteria in SRP-LR Section 3.1.2.2.12; AMR Item 33 in Table 1 of the GALL Report, Volume 1; and AMR items IV.B2-1, IV.B2-4, IV.B2-7, IV.B2-11, IV.B2-15, IV.B2-19, IV.B2-23, IV.B2-27, IV.B2-29, IV.B2-35, IV.B2-39, and IV.B2-41 in the GALL Report, Volume 2.

The staff verified that the applicant does include applicable AMR items in LRA Table 3.1.2-2 that align to and conform with the recommendations in GALL AMR items IV.B2-1, IV.B2-4, IV.B2-7, IV.B2-11, IV.B2-15, IV.B2-19, IV.B2-23, IV.B2-27, IV.B2-29, IV.B2-35, IV.B2-39, and IV.B2-41 to manage changes in dimensions due to void swelling in the baffle/former assembly plates; baffle/former assembly bolts; core barrel (CB), CB flange, CB outlet nozzles, and thermal shield; flux thimble guide tubes in the instrument support structure; fuel alignment pins, lower support plate column bolts, and clevis insert bolts in the lower internals assembly; lower core plates and radial keys and clevis inserts in the lower internals assembly; lower support castings/forgings and lower support plate columns in the lower internals assembly; RCCA guide tube bolts and support pins in the RCCS guide tube assembly; RCCA guide tubes in the RCCA guide tube assembly; upper support columns in the upper internals assembly; upper support column bolts, upper core plate alignment pins, and fuel alignment pins in the upper internals assembly; and upper support plate, upper core plate, and hold-down springs in the upper internals assembly as a result of exposing the components to the reactor coolant.

The staff also verified that applicant has conservatively aligned its AMRs on changes in dimensions due to void swelling for the following additional stainless steel RVI components to either GALL AMR IV.B2-4, IV.B2-11, IV.B2-19, IV.B2-23, or IV.B2-41, as follows:

- core barrel assembly bolts (aligning to GALL AMR IV.B2-4)
- thermocouple conduits in the instrumentation support structures (aligning to GALL AMR IV.B2-11)
- diffuser plate in the lower internals assembly (specific to BVPS Unit 1, aligning to GALL AMR IV.B2-19)
- secondary core support, head vessel alignment pin, and head cooling spray nozzles in the lower internals assemblies (aligning to GALL AMR IV.B2-23)
- upper core plates, upper support plate and support assemblies in the upper internals assemblies (aligning to GALL AMR IV.B2-41)

The staff finds this to be acceptable because the applicant has determined that the material of fabrication, environment, and aging effect for the components are the same as those identified for the commodity groups addressed in the respective GALL AMRs and because it is in conformance with Footnote C Type "2" AMRs, as provided in the latest edition of the license renewal guidelines in NEI Report #NEI-95-10, Revision 6 [June 15, 2005], and which was endorsed by the NRC in NUREG-1.188, Revision 1 [September 2005].

For these stainless steel, CASS, or nickel-alloy RVI components, the staff verified that the applicant credits its commitments for PWR RVI components to manage changes in dimensions due to void swelling, as follows:

> "For the PWR Vessel Internals Program, regarding activities for managing the aging of Reactor Vessel internal components and structures, BVPS commits to:
>
> (1) Participate in the industry programs applicable to BVPS Unit 1/Unit 2 for investigating and managing aging effects on reactor internals;
>
> (2) Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1/Unit 2 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 the BVPS Unit 1/Unit 2 reactor internals to the NRC for review and approval."

The staff verified that the applicant includes this commitment in Commitment No. 18 of LRA UFSAR Supplement Table A.4-1 for BVPS Unit 1 and in Commitment No. 20 of LRA UFSAR Supplement Table A.5-1 for BVPS Unit 2. Based on this review, the staff finds that the applicant has credited an acceptable AMR basis to manage changes in dimensions due to void swelling in the stated core/former assembly, lower internals assembly, core barrel assembly, upper internals assembly, and instrumentation support structure components because the commitments credited to further evaluate these components, and to manage changes in dimensions due to void swelling of these components, have been verified to be in conformance with the staff's recommended criteria in SRP-LR Section 3.1.2.2.15 and the GALL AMRs that are invoked by this SRP-LR section.

Based on the commitments identified and discussed above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.1.2.2.15 to manage changes in dimensions due to void swelling in the stated core/former assembly, lower internals assembly, core barrel assembly, upper internals assembly, and instrumentation support structure components, and that for these components, the applicant has met the criteria in SRP-LR Section SRP-LR Section 3.1.2.2.15 to manage this aging effect. For those AMR items that apply to LRA Section 3.1.2.2.15, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.16 Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking

Control Rod Drive Head Penetration Pressure Housings and Primary Side Steam Generator Heads, Tubesheets, and Welds. LRA Section 3.1.2.2.16.1 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.1.2.2.16.1, "Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking, *Control Rod Drive Head Penetration Pressure Housings and Primary Side Steam Generator Heads, Tubesheets, and Welds*," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that cracking due to stress corrosion cracking (SCC) and/or primary water stress corrosion cracking (PWSCC) could occur in the primary coolant side of the BVPS steam generator (SG) upper and lower heads, tubesheets, and tube-to-tubesheet welds made or clad with stainless steel or nickel-alloy.

The applicant states that it credits its Water Chemistry Program and its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to manage cracking due to SCC or PWSCC in the stainless steel or Nickel-component surfaces that are exposed to the reactor coolant.

The applicant clarifies that BVPS does not have nickel-alloy pressure housings. The applicant clarifies that its AMR on PWSCC-induced cracking of its nickel-alloy components, nozzles and welds is addressed in LRA Table 3.1.1, AMR item 3.1.1-31 with associated LRA Section 3.1.2.2.13, AMR item 3.1.1-65, and AMR item 3.1.1-69.

SRP-LR Section 3.1.2.2.16.1 provides the following guidance on aging management of cracking due SCC and/or PWSCC in the primary coolant side of PWR steam generator upper and lower heads, tubesheets, and tube-to-tubesheet welds made or clad with stainless steel or nickel-alloy materials:

> "Cracking due to SCC could occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with stainless steel. Cracking due to PWSCC could occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with nickel-alloy. The GALL Report recommends ASME Section XI ISI and control of water chemistry to manage this aging and recommends no further aging management review for PWSCC of nickel-alloy if the applicant complies with applicable NRC Orders and provides a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2)
> staff-accepted industry guidelines."

SRP-LR Section 3.1.2.2.16.1 invokes AMR Item 35 in Table 1 of the GALL Report, Volume 1, and AMR item IV.D2-4 in the GALL Report Volume 2, as applicable to the management of cracking due to SCC and/or PWSCC in the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tubesheet welds clad with stainless steel or nickel-alloy materials in once-through steam generators. In these AMR items, the staff recommends that the Water Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program be credited to manage cracking due to SCC and/or PWSCC in these stainless steel or nickel-alloy clad components as a result of exposure to the reactor coolant. For the components clad with nickel-alloy materials, the staff also recommends that the applicant include a commitment on the UFSAR Supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines. This is consistent with the guidance in SRP-LR Section 3.1.2.2.16.1.

The staff reviewed LRA Section 3.1.2.2.16.1 and the applicant's AMRs of management of cracking due to SCC and/or PWSCC in the steam generator upper and lower heads, tubesheets, and tube-to-tubesheet welds made or clad with nickel-alloy, and in the stainless steel control rod drive mechanism (CRDM) pressure housings, against the staff's recommended regulatory criteria in SRP-LR Section 3.1.2.2.16.1; AMR Item 35 in Table 1 of the GALL Report, Volume 1; and AMR item IV.D2-4 in the GALL Report, Volume 2.

The staff verified that the applicant has conservatively aligned this item to its evaluation of the stainless steel CRDM pressure housings. The staff also verified that the applicant's AMRs to manage cracking in these housings are given in LRA Table 3.1.1, AMR Item 3.1.1-34, and in AMR items 49 and 50 in LRA Table 3.1.2-1, as applicable to the management of cracking due to SCC and/or PWSCC in the surfaces of the stainless steel CRDM pressure housings that are exposed to the reactor coolant. In these AMRs, the applicant identifies that the AMRs are entirely consistent with the NRC's recommended AMR criteria in AMR item 34 of the GALL Report, Volume 1, and AMR item IV.A2-11 in the GALL Report, Volume 2, without exception. The staff has verified that, consistent with guidelines in SRP-LR Section 3.1.2.2.16.1, the applicant credits its Water Chemistry Program and ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program to manage cracking due to SCC and/or PWSCC in the stainless steel housing surfaces that are exposed to the reactor coolant. The staff finds this aging management approach to be acceptable because it is consistent with the criteria and AMPs recommended for aging management of cracking in SRP-LR Section 3.1.2.2.16.1.

The staff verified that the steam generators (SGs) at BVPS are Westinghouse designed recirculating SGs (Model 54F for BVPS Unit 1 and Model 51M for BVPS Unit 2). Based on this review, the staff finds that the staff's guidance criteria in SRP-LR Section 3.1.2.2.16-1, AMR Item 35 in Table 1 of the GALL Report, Volume 1; and AMR item IV.D2-4 in the GALL Report, Volume 2, are not applicable to BVPS SG designs. Instead, the staff has also verified that the applicant provides its AMRs on management of cracking due to SCC and/or PWSCC in the steel SG tubesheets and associated tube-to-tubesheet welds that are clad with nickel-alloy material in LRA Table 3.1.1, AMR Item 3.1.1-31, and in AMR items 233, 234, and 235 in LRA Table 3.1.2-3. The staff verified that the applicant further evaluates cracking due to SCC and/or PWSCC of these components in LRA Section 3.1.2.2.13. The staff provides its evaluation of the applicant's AMR basis for managing cracking due to SCC and/or PWSCC in for these nickel-alloy components in SER Section 3.1.2.2.13.

The staff has verified that the SG heads and shells at BPVS are not clad with nickel-alloy or stainless steel materials and are not exposed to the reactor coolant. The staff has verified that, instead, the BVPS SG shells and heads are fabricated from steel materials and that the internal surfaces of the SG shells and heads are exposed to a secondary feedwater/steam environment. The staff verified that the GALL Report does not identify that cracking due to SCC is an aging effect requiring management for these steel SG components under exposure to a secondary feedwater/steam environment.

Based on the programs identified above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.1.2.2.16.1 to manage cracking due to SCC and/or PWSCC in the surfaces of the stainless steel CRDM pressure housings that are exposed to the reactor coolant, and that for these components, the applicant has met the criteria in SRP-LR Section 3.1.2.2.16.1 to manage this aging effect. For those CRDM pressure housings AMR 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 the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also concludes that SRP-LR Section 3.1.2.2.16.1 is not applicable to the AMRs on management of cracking due to SCC and/or PWSCC in the BVPS SG components because the SRP-LR section, and the AMR items in the GALL Report, Volume 1, and the GALL Report, Volume 2, invoked by the SRP-LR section, is applicable once-through SG designs, and because the SG designs at BVPS are recirculating SGs.

<u>Cracking Due to SCC and PWSCC of Pressurizer Spray Heads</u>. LRA Section 3.1.2.2.16.2 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.1.2.2.16.2, "Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking, Pressurizer Spray Heads," is applicable to the BVPS LRA. In this Section of the LRA, the applicant identifies that the pressurizer spray head at BVPS is fabricated from cast austenitic stainless steel (CASS) and that the component is designed with a stainless steel coupling and locking bar. The applicant's states that cracking due to stress corrosion cracking (SCC) and/or primary water stress corrosion cracking (PWSCC) is a aging effect requiring management (AERM) for the BVPS pressurizer spray heads.

The applicant states that it credits its Water Chemistry Program to manage cracking due to SCC and/or PWSCC in the pressurizer spray heads, and that the One-Time Inspection Program is credited to verify the effectiveness of the Water Chemistry Program in managing cracking due to SCC and/or PWSCC in pressurizer spray heads. The applicant clarifies that the associated commitment mentioned in SRP-LR Section 3.1.2.2.16.2 is not necessary because the pressurizer spray heads are not fabricated from nickel-alloy materials.

SRP-LR Section 3.1.2.2.16.2 provides the following guidance on aging management of cracking due SCC and/or PWSCC in PWR pressurizer spray heads:

> "Cracking due to SCC could occur on stainless steel pressurizer spray heads. Cracking due to PWSCC could occur on nickel-alloy pressurizer spray heads. The existing program relies on control of water chemistry to mitigate this aging effect. The GALL Report recommends one-time inspection to confirm that cracking is not occurring. For nickel-alloy welded spray heads, the GALL Report recommends no further aging management review if the applicant complies with applicable NRC Orders and provide a commitment in the FSAR supplement to implement applicable (1) Bulletins and Generic Letters and (2) staff-accepted industry guidelines."

SRP-LR Section 3.1.2.2.16.2 invokes AMR Item 36 in Table 1 of the GALL Report, Volume 1, and AMR item IV.C2-17 in the GALL Report Volume 2, as applicable to the management of SCC in pressurizer spray heads made from stainless steel or PWSCC in pressurzier spray heads made from nickel-alloy. In these AMRs, the staff recommends that the Water Chemistry Program be credited to manage cracking due to SCC and/or PWSCC in the pressurizer spray head, and that the One-Time Inspection Program be credited to verify the effectiveness of the Water Chemistry Program in managing this aging effect. For pressurizer spray heads made from nickel-alloy materials, the staff also recommends that a commitment on the UFSAR supplement be made to implement: (1) applicable NRC Bulletins and Generic Letters, and (2) staff-accepted industry guidelines. This is consistent with the guidance in SRP-LR Section 3.1.2.2.1.16.2.

The staff reviewed LRA Section 3.1.2.2.16.2 and the applicant's AMRs of management of cracking due to SCC and/or PWSCC in the pressurizer spray heads against the staff's recommended criteria in SRP-LR Section 3.1.2.2.16.2; AMR Item 36 in Table 1 of the GALL Report, Volume 1; and AMR item IV.C2-17 in the GALL Report, Volume 2.

The staff verified that, in the LRA, the applicant identifies that the pressurizer spray heads at BPVS are fabricated from CASS, which is a special form of stainless steel. The staff also verified that the applicant does include applicable AMR items in LRA Table 3.1.2-3 that align to and conform with the recommendations in GALL AMR item IV.C2-17 to manage cracking due to SCC and/or PWSCC in the CASS pressurizer spray heads and that in these AMRs, the applicant credits its Water Chemistry Program to manage cracking due to SCC and/or PWSCC in the CASS pressurizer spray heads as a result of exposure to the reactor coolant. The staff also verified that the applicant credits its One-Time Inspection Program to verify the effectiveness of Water Chemistry Program in managing this aging effect. The staff finds that the applicant's crediting of these programs for aging management of cracking due to SCC and/or PWSCC in the pressurizer spray heads is consistent with the staff aging management criteria in

SRP-LR Section 3.1.2.2.16.2; AMR Item 36 in Table 1 of the GALL Report, Volume 1; and AMR item IV.C2-17 in the GALL Report, Volume 2, and is acceptable.

In RAI 3.1.2.2.16.2-1, the staff asked the applicant to clarify whether or not the CASS pressurizer spray heads are secured to the pressurizer upper head using a nickel-alloy weld material, and if so, to justify why the commitment mentioned SRP-LR Section 3.1.2.2.16.2 and in GALL AMR item IV.C2-17 has not been credited for aging management cracking due to SCC and/or PWSCC in the pressurizer spray heads at BVPS.

The applicant responded to RAI 3.1.2.2.16.2-1 in a letter dated July 21, 2008. In this letter, the applicant explained that there are no nickel-alloy components or weld material associated with the pressurizer spray heads within the pressurizers. The applicant further explained that the spray heads at both units are fabricated of cast austenitic stainless steel and are secured by threading to spray head couplings (pipes) and locking bars, which are fabricated of stainless steel. The applicant also stated that these components are compared to the GALL Report, row IV.C2-17, for management of cracking in LRA Table 3.1.2-3, rows 126 and 127. The applicant stated that, LRA Table 3.1.1, Item Number 3.1.1-36, and Further Evaluation Section 3.1.2.2.16.2 explains that the pressurizer spray heads are fabricated from cast austenitic stainless steel and not from nickel-alloy.

The applicant however, stated that the pressurizer spray nozzle safe end welds (external to the pressurizer upper head) at both units are nickel-, and are compared to NUREG-1801, row IV.C2-24, for management of cracking in LRA Table 3.1.2-3, items 111, 112, and 113. For this example the applicant identified LRA Table 3.1.1, Item Number 3.1.1-31, and Further Evaluation Section 3.1.2.2.13. The applicant provided commitments for the nickel-alloy components and nickel-alloy clad components in LRA Table A.4-1, "Unit 1 License Renewal Commitments," Item Number 15, and Table A.5-1, "Unit 2 License Renewal Commitments," Item Number 17, to develop a plant-specific aging management program that will implement applicable (1) NRC Orders, Bulletins and Generic Letters, and (2) staff-accepted industry guidelines.

The staff reviewed the applicant’s response and LRA Section 3.1.2.2.16.2 and finds that it adequately explains that the pressurizer spray nozzles within the pressurizer steam space are fabricated from cast austenitic stainless steel and not from nickel-alloy. On this basis the staff finds acceptable that a no commitment regarding nickel-alloy spray head inspection is required because the pressurizer spray head is not fabricated from nickel-alloy material or secured using a nickel-alloy bimetallic filler metal. Further, the applicant’s Water Chemistry Program and One-Time Inspection Program would mitigate and detect the cracking to assure the intended function of the pressurizer nozzle spray heads during the period of extended operation in accordance with GALL Report AMR Item IV.C2-17.

Based on this review, the staff found that the applicant’s basis for crediting of the Water Chemistry Program and the One-Time Inspection Program to manage cracking due to SCC and/or PWSCC, or IASCC in the pressurizer spray heads is acceptable because it is consistent with the staff’s recommendations and criteria in SRP-LR Section 3.1.2.2.16.2, and the GALL AMRs invoked by this SRP-LR section. Therefore the staff’s concern in RAI 3.1.2.2.16.2-1 is resolved.

Based on the programs identified above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.1.2.2.16.2 to manage cracking due to

SCC and/or PWSCC in the pressurizer spray heads, and that for these components, the applicant has met the criteria in SRP-LR Section 3.1.2.2.16.2 to manage this aging effect. 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 the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.17 Cracking Due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

LRA Section 3.1.2.2.17 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.1.2.2.17, "Cracking Due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that cracking due to stress corrosion cracking (SCC), primary water stress corrosion cracking (PWSCC, a form of SCC), or irradiation-assisted stress corrosion cracking (IASCC, a form of SCC) could occur in the reactor vessel internal (RVI) components made from stainless steel or nickel-alloy materials.

The applicant states that it credits its commitments for PWR RVI components to manage cracking due to SCC, PWSCC, or IASCC in the stainless steel or nickel-alloy RVI components and includes these commitments in Commitment No. 18 of Unit 1 UFSAR Supplement Table A4-1 and Commitment No. 20 of Unit 2 UFSAR Supplement Table A5-1, as follows:

> "(1) Participate in the industry programs applicable to BVPS Unit 1/Unit 2 for investigating and managing aging effects on reactor internals;
>
> (2) Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1/Unit 2 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 the BVPS Unit 1/Unit 2 reactor internals to the NRC for review and approval."

SRP-LR Section 3.1.2.2.17 provides the following guidance on aging management of cracking due to SCC, PWSCC, or IASCC in RVI components that are made from stainless steel or nickel-alloy materials:

> "Cracking due to stress corrosion cracking (SCC), primary water stress corrosion cracking (PWSCC), and irradiation assisted stress corrosion cracking (IASCC) could occur in PWR stainless steel and nickel-alloy reactor vessel internals components. The existing program relies on control of water chemistry to mitigate these effects. However, the existing program should be augmented to manage these aging effects for reactor vessel internals components. The GALL Report recommends no further aging management review if the applicant provides a commitment in the FSAR 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."

For RVI components in Westinghouse-designed PWRs, SRP-LR Section 3.1.2.2.12 invokes AMR Item 37 in Table 1 of the GALL Report, Volume 1, and AMR items IV.B2-16, IV.B2-20, IV.B2-28, and IV.B2-40 in the GALL Report, Volume 2, as applicable to the management of cracking due to SCC, PWSCC, or IASCC in the fuel alignment pins, lower support plate column bolts, and clevis insert pins of the lower internals assembly; lower core plates, radial keys, and clevis inserts of the lower internals assembly; RCCA guide tube bolts and pins of the RCCA assembly; and upper support column bolts, upper core plate alignment pins, and fuel alignment pins of the upper core assembly as a result of exposure the components to the reactor coolant. In these GALL AMRs, the staff states that no aging management is necessary if the applicant incorporates a commitment on UFSAR supplement to: "(1) participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, submit an inspection plan for reactor internals to the NRC for review and approval." This is consistent with the guidance in SRP-LR Section 3.1.2.2.17.

The staff reviewed LRA Section 3.1.2.2.17 and the applicant's AMRs of management of cracking due to SCC, PWSCC, or IASSC in specific BVPS RVI components against the staff's recommended regulatory criteria in SRP-LR Section 3.1.2.2.17; AMR Item 37 in Table 1 of the GALL Report, Volume 1; and AMR items IV.B2-16, IV.B2-20, IV.B2-28, and IV.B2-40 in the GALL Report, Volume 2.

The staff verified that the applicant does include applicable AMR items in LRA Table 3.1.2-2 that align to and conform with the recommendations in GALL AMRs AMR items IV.B2-16, IV.B2-20, IV.B2-28, and IV.B2-40 to manage cracking due to SCC, PWSCC, or IASCC in the fuel alignment pins, lower support plate column bolts, and clevis insert pins of the lower internals assembly; lower core plates, radial keys, and clevis inserts of the lower internals assembly; RCCA guide tube bolts and pins of the RCCA assembly; and upper support column bolts, upper core plate alignment pins, and fuel alignment pins of the upper core assembly as a result of exposing the components to the reactor coolant, and for some of these components to an integrated neutron flux.

The staff also verified that applicant has conservatively aligned its AMRs on cracking due to SCC, PWSCC, or IASCC of the BVPS Unit 1 diffuser plate to GALL AMR IV.B2-20. The staff finds this to be acceptable because the applicant has determined that the material of fabrication, environment, and aging effect for the components are the same as those identified for the commodity groups addressed in the respective GALL AMRs and because it is in conformance with Footnote C Type "2" AMRs, as provided in the latest edition of the license renewal guidelines in NEI Report #NEI-95-10, Revision 6 [June 15, 2005], and which was endorsed by the NRC in NUREG-1.188, Revision 1 [September 2005].

For these stainless steel or nickel-alloy RVI components, the staff verified that the applicant credits its commitments for PWR RVI components to manage cracking due to SCC, PWSCC, or IASCC in the stainless steel and nickel-alloy RVI components, as follows:

"For the PWR Vessel Internals Program, regarding activities for managing the aging of Reactor Vessel internal components and structures, BVPS commits to:

(1) Participate in the industry programs applicable to BVPS Unit 1/Uni 2 for investigating and managing aging effects on reactor internals;

(2) Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1/Unit 2 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 the BVPS Unit 1/Unit 2 reactor internals to the NRC for review and approval."

The staff verified that the applicant includes this commitment in Commitment No. 18 of LRA UFSAR Supplement Table A.4-1 for BVPS Unit 1 and in Commitment No. 20 of LRA UFSAR Supplement Table A.5-1 for BVPS Unit 2. As a result as this review, the staff finds that the applicant has credited an acceptable AMR basis to manage cracking due to SCC, PWSCC. or IASCC in the fuel alignment pins, lower support plate column bolts, and clevis insert pins of the lower internals assembly; lower core plates, radial keys, and clevis inserts of the lower internals assembly; RCCA guide tube bolts and pins of the RCCA assembly; and upper support column bolts, upper core plate alignment pins, and fuel alignment pins of the upper core assembly because the commitment credited to further evaluate these components, and to manage cracking due to SCC, PWSCC, or IASCC in these components, have been verified to be in conformance with the staff's recommended criteria in SRP-LR Section 3.1.2.2.17 and the GALL AMRs that are invoked by this SRP-LR section.

Based on the commitments identified and discussed above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.1.2.2.17 to manage cracking due to SCC, PWSCC, or IASCC in the fuel alignment pins, lower support plate column bolts, and clevis insert pins of the lower internals assembly; lower core plates, radial keys, and clevis inserts of the lower internals assembly; RCCA guide tube bolts and pins of the RCCA assembly; and upper support column bolts, upper core plate alignment pins, and fuel alignment pins of the upper core assembly, and that for these components, the applicant has met the criteria in SRP-LR Section SRP-LR Section 3.1.2.2.17 to manage this aging effect. 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 the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.18 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 3.1.2-3, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.1.2-1 through 3.1.2-3, the applicant indicated, via notes F through J, which the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.1.2.3.1 Reactor Vessel - Summary of Aging Management Evaluation – LRA Table 3.1.2-1

The staff reviewed LRA Table 3.1.2-1, which summarizes the results of AMR evaluations for the reactor vessel component groups.

In LRA Table 3.2.2-1, line items 28 and 115, the applicant includes plant-specific AMRs on managmement of cracking in the steel reactor vessel (RV) lifting lugs and steel refueling seal ledge ring. In these AMRs, the applicant proposed to manage cracking of the steel component surfaces that are exposed to air with borated water leakage using AMP B.2.2, ASME Section XI inservice inspection, Subsections IWB, IWC, and IWD. The applicant stated that the aging effect, cracking, is not in GALL for this component, material, environment combination. The staff was not able to find either of these components in GALL or the SRP. The staff noted that, although the GALL Report includes AMR items for steel exposed to air with reactor coolant leakage in Chapter IV, Reactor Vessel, Internals, and Reactor Coolant System, the AMRs are applicable to steel bolted connections, and thus, the AMP recommended for management of cracking in the bolted components is the Bolting Intergrity Program (GALL AMP XI.M18).

The staff noted that the components addressed in these plant-specific AMRs are not bolted connections. As a result, the staff noted that the applicant has credited its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program (LRA AMP B.2.2) to manage cracking in these steel RV components. The staff has verified that the applicant's ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD Program is a valid condition monitoring program to credit to ASME Code Class 1 components including the RV lifting lugs and the refueling seal ledge. The staff reviewed the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.2) and its evaluation is documented in SER Section 3.0.3.2.1. The staff's evaluation includes its basis for concluding that the applicant's is consistent with the staff recommended program element in GALL AMP XI.M1, "Inservice Inspection Subsections IWB, IWC, and IWD," with the exception that the applicant is using the 1989 Edition of the ASME Code rather than the 2001 Edition with the 2003 Addenda. This exception has been reviewed by the staff and has been found to be acceptable. Therefore, the staff finds that the applicant's proposal to credit its ASME Section XI Inservice Inspection

Subsections IWB, IWC, and IWD Program for the management of cracking in these components is acceptable because this is appropriate condition monitoring program to credit for ASME Code Class 1 components.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.2 Reactor Vessel Internals - Summary of Aging Management Evaluation – LRA Table 3.1.2-2

The staff reviewed LRA Table 3.1.2-2, which summarizes the results of AMR evaluations for the reactor vessel internals component groups. The staff determined that the LRA Table 3.1.2-2 did not include any plant-specific AMR items (as identified by either a Footnote F, G, H, I, or J designation) for the RVI components.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant did not need to address the adequacy of any plant-specific AMRs for the RVI components because the applicant’s AMR items in LRA Table 3.1.2-2 for RVI components did not include any plant-specific AMR items for the components associated with the RVI subsystem.

3.1.2.3.3 Reactor Coolant System - Summary of Aging Management Evaluation – LRA Table 3.1.2-3

The staff reviewed LRA Table 3.1.2-3, which summarizes the results of AMR evaluations for the RCS component groups.

In LRA Table 3.1.2-3, the applicant includes its plant-specific AMRs for managing reduction of heat transfer function for the BVPS Unit 1 regenerative heat exchanger (HX) tubes and the BVPS Unit 1 and 2 thermal barrier heat exchangers, which are located within the design of the reactor coolant pumps (RCPs). In these AMRs, the applicant proposed to manage reduction of heat transfer in these stainless steel heat exchanger (Unit 1 regen tubes) and heat exchanger (thermal barrier HX) HXs using a combination of the Water Chemistry Program (LRA AMP B.2.42) and the One-Time Inspection Program (LRA AMP B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H.

The staff noted that in Table IX.E in the GALL Report, Volume 2, the staff identifies that reduction of heat transfer function results from the fouling of HX tubes or fins by the buildup of foreign materials on the heat transfer surfaces. The staff also noted, that in order to manage this aging effect the applicant would either have to credit a preventative AMP (such as the Water Chemistry Program which would prevent the precipitation of foreign materials like oxides from building up of the heat transfer surfaces or a condition monitoring program or performance monitoring program (i.e., monitoring by either inspection or by verification of performance parameters) to man.

The staff noted that the applicant was crediting its Water Chemistry Program to manage reduction of heat transfer function as a result of fouling in the external surfaces of the BVPS Unit 1 regenerative heat exchangers and the BVPS Unit 1 and 2 external RCP thermal barrier surfaces, both of which are exposed externally to the reactor coolant. The staff noted that the applicant's accomplishes this by controlling the concentrations of dissolved oxygen and ionic compound impurities to extremely low levels to minimize the chance of oxides or other ionic compounds plating out onto the external component surfaces. The staff has verified that the applicant identifies its Water Chemistry Program as an mitigative-based AMP that, when enhanced to modify the frequency for silicate sampling and testing, will be consistent with the staff's program element criteria in GALL AMP XI.M2, "Water Chemistry."

During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The staff's evaluation of the Water Chemistry Program is given in SER Section 3.0.3.2.14, which includes the staff's basis for concluding that the applicant's Water Chemistry Program when enhanced will be acceptable in accordance with the program element recommendations in GALL AMP XI.M2.

The staff noted that the applicant is crediting its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing reduction of heat transfer function as a result of fouling in the external surfaces of the BVPS Unit 1 regenerative heat exchangers and the BVPS Unit 1 and 2 external RCP thermal barrier surfaces, both of which are exposed to the reactor coolant. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Although reduction of heat transfer is not an aging effect covered in the GALL Report for stainless steel heat exchanger tubes or other heat transfer surfaces exposed to reactor coolant. However, the staff has confirmed there are similar heat exchangers with stainless steel tubes or other heat transfer surfaces in the GALL Report using the combination of the Water Chemistry Program and One-Time Inspection Program to manage reduction of heat transfer. The staff finds this to be an acceptable basis because GALL AMP XI.M32 states that one-time inspection programs are appropriate program for verifying "the system-wide effectiveness of an AMP that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation," such as the Water Chemistry Program. Further, the staff's evaluation of the Water Chemistry Program finds that it would maintain reactor coolant quality through treatment and testing. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.1.2-3, the applicant proposed to manage cumulative fatigue damage of stainless steel steam generator anti-vibration bars and tube support plate for BVPS Unit 1 exposed to secondary feedwater/steam as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.1.2-3, the applicant includes its plant-specific AMR items for management of loss of material in stainless steel (including cast austenitic stainless steel or CASS) piping, piping components, and piping elements that are exposed to the treated water. The scope of these AMRs covers the following stainless steel (including CASS) components: piping, valve bodies, hydraulic isolators, and tubing. In these AMRs, the applicant credited its Water Chemistry Program to manage loss of material in the component surfaces that are exposed to the treated water and its One-Time Inspection Program to verify the effectiveness of the water chemistry program in managing loss of material in the component surfaces that are exposed to treated water.

GALL AMP XI.M2, “Water Chemistry” identifies that water chemistry control programs are appropriate mitigative programs to use for management of aging effects that are induced by corrosive aging effects, including loss of material that is induced by the mechanisms of general, pitting, or crevice corrosion. Stainless steel components are designed by the alloying contents to be resistant to these aging mechanisms. Therefore, based on this assessment, the staff concludes that the applicant has provided an acceptable basis for managing loss of material of these stainless steel components because it is consistent with the staff’s basis in GALL AMP XI.M2, “Water Chemistry” on when it is appropriate to credit mitigative-based water chemistry programs for aging management.

GALL AMP XI.M32 states that one-time inspection programs are appropriate programs to credit for aging management for cases where it is necessary to verify the system-wide effectiveness of an AMP that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. Based on this assessment, the staff finds that the applicant has provided an acceptable basis for crediting the One-Time Inspection Program for aging management because the applicant will use the program to verify the effectiveness of the Water Chemistry Program in managing loss of the material in the stainless steel component surfaces that are exposed to treated water and because the applicant’s basis is in conformance with the staff’s position in GALL AMP XI.M32 on when it is valid to credit one-time inspection programs for aging management.

In LRA Table 3.1.2-3, the applicant includes its plant-specific AMR items for management of loss of material in steel pressurizer relief tanks that are exposed to the treated water. In these AMRs, the applicant credited its Water Chemistry Program to manage loss of material in the component surfaces that are exposed to the treated water and its One-Time Inspection Program to verify the effectiveness of the water chemistry program in managing loss of material in the component surfaces that are exposed to treated water.

GALL AMR item VIII.B1-11 indicates that it is applicable to credit a combination of the Water Chemistry Program and the One-time Inspection Program for steel piping, piping components, and piping elements in the main steam system that are exposed to treated water. The staff noted that the applicant’s aging management basis for the pressurizer relief tanks is valid because pressurizer relief tanks are not categorized as ASME Code Class 1 reactor coolant pressure boundary components for BVPS. In addition, the staff noted that GALL AMP XI.M2, “Water Chemistry” identifies that water chemistry control programs are appropriate mitigative programs to use for management of aging effects that are induced by corrosive aging effects, including loss of material that is induced by the mechanisms of general, pitting, or crevice corrosion.

The staff also noted that GALL AMP XI.M32 states that one-time inspection programs are appropriate programs to credit for aging management for cases where it necessary to verify the system-wide effectiveness of an AMP that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation. Therefore, based on this assessment, the staff concludes that the applicant has provided an acceptable basis for managing loss of material of the steel pressurizer relief tanks because it is consistent with the staff's recommended AMR basis in GALL AMR VIII.B1-11 as applicable to non-ASME Code Class components, with the staff's recommended aging management basis in GALL AMP XI.M2, "Water Chemistry" on when it is appropriate to use mitigative-based water chemistry programs for aging management, and with the staff's recommended aging management basis in GALL AMP XI.M32 on when it is appropriate to credit one-time inspection program for aging management.

In LRA Table 3.1.2-3, the applicant includes its plant-specific AMR items for management of reduction of heat transfer in nickel-alloy steam generator (SG) tubes that are exposed to the reactor coolant. In these AMRs, the applicant credited its Water Chemistry Program and its Steam Generator Tube Integrity Program to manage reduction of heat transfer in the tube surfaces that are exposed to the borated water environment of the reactor coolant.

The staff noted that the staff recommends that GALL AMR Tables IV.D1 for recirculating SGs does not include any AMRs on management of reduction of heat transfer of nickel-alloy steam generator tubes. The staff has noted that GALL AMR Table IV.D1 does include other AMR items (e.g. AMRs IV.D1-20 and IV.D1-22 through IV.D1-24) on management of cracking and loss of material in nickel-alloy recirculating SG tubes and that in these AMRs, the staff recommends that AMPs corresponding to GALL AMP XI.M2, "Water Chemistry," and XI.M19, "Steam Generator Tube Integrity," be credited to aging management of the aging effects. The applicant's plant-specific aging management basis for crediting its Water Chemistry Program and its Steam Generator Tube Integrity Program to manage reduction of heat transfer in the tube surfaces that are exposed to the borated water environment of the reactor coolant is consistent with this approach for aging management GALL AMR items IV. D1-20 and IV.D1-22 through IV.D1-24. Based on this review the staff finds the applicant's aging management basis for these components is acceptable because it is in conformance with the staff's recommended basis for managing reduction of heat transfer as defined in GALL AMR items IV. D1-20 and IV.D1-22.

In LRA Table 3.1.2-3, the applicant includes its plant-specific AMR items for management of loss of material in nickel-alloy steam generator (SG) flow limiters and secondary manway hand-hole inserts that are exposed to the secondary feedwater or steam. In these AMRs, the applicant credited its Water Chemistry Program to manage loss of material in the component surfaces that are exposed to the secondary feedwater or steam.

The staff noted that the American Welding Society (AWS) "Welding Handbook," (Seventh Edition, Volume 4, 1982, Library of Congress) identifies that nickel chromium alloy materials that are alloyed with iron, molybdenum, tungsten, cobalt or copper in various combinations have improved corrosion resistance. In contrast the applicant has conservatively assumed that these secondary side SG nickel-alloy components may be susceptible to loss of material by and has conservatively credited its Water Chemistry Program to manage this aging effect for components surfaces that are exposed to a secondary treated water or steam environment. GALL AMP XI.M2, "Water Chemistry," states that water chemistry programs are appropriate to use to aging management of components that may be susceptible to either corrosion or stress corrosion cracking, and that for PWR designed reactors, the program "relies on monitoring and control of reactor water chemistry based on industry guidelines for primary water and secondary water chemistry such as EPRI TR-105714, Revision 3 and TR-102134, Revision 3 or later revisions" in order to mitigate the damage caused by corrosion and stress corrosion cracking (SCC). The staff has noted that the applicant identifies its Water Chemistry Program as an

AMP that is consistent with the staff program elements in GALL AMP XI.M2. The staff evaluates the ability of the applicant's Water Chemistry Program to manage loss of material in SG components in SER Section3.0.3.2.14. The staff's basis includes its basis for accepting an updated version of the EPRI PWR Water Chemistry Guidelines for aging management of the plant's components. Based on this review, the staff finds the applicant's plant-specific basis for managing loss of material in these secondary side SG nickel-alloy components because the components are typically designed to be resistant to the aging mechanisms of general, pitting, and crevice corrosion, and because the applicant basis for crediting the Water Chemistry Program is consistent with the basis in GALL AMP XI.M2 on when it is valid to credit water chemistry programs for aging management of corrosion-based aging effects.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the reactor vessel, reactor vessel internals, and RCS components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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 ESF components and component groups of:

- containment depressurization system
- residual heat removal system
- safety injection system

3.2.1 Summary of Technical Information in the Application

LRA Section 3.2 provides AMR results for the ESF components and component groups. LRA Table 3.2.1, "Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the 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 condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.2.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the ESF components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of 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 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 3.2.2.1.

In the onsite audit, the staff also 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 3.2.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.2.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.2.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.2-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.2 and addressed in the GALL Report.

Table 3.2-1 Staff Evaluation for Engineered Safety Features Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel and stainless steel piping, piping components, and piping elements in emergency core cooling system (3.2.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Consistent with the GALL Report (See SER 3.2.2.2.1)

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 with stainless steel cladding pump casing exposed to treated borated water (3.2.1-2)	Loss of material due to cladding breach	A plant-specific aging management program is to be evaluated. Reference NRC Information Notice 94-63, “Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks”	Yes	Not applicable	Not Applicable to BVPS (See SER Section 3.2.2.2.2)
Stainless steel containment isolation piping and components internal surfaces exposed to treated water (3.2.1-3)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not Applicable to BVPS (See SER Section 3.2.2.1.1)
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 aging management program is to be evaluated.	Yes	One Time Inspection (B.2.30)	Consistent with the GALL Report (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	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (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	Not applicable	Not Applicable (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
Partially encased stainless steel tanks with breached moisture barrier exposed to raw water (3.2.1-7)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottoms because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
Stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation (internal) (3.2.1-8)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report (See SER Section 3.2.2.2.3.6)
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil (3.2.1-9)	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
Stainless steel heat exchanger tubes exposed to treated water (3.2.1-10)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Not Applicable (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 aging management program 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 (charging) pump miniflow orifice exposed to treated borated water (3.2.1-12)	Loss of material due to erosion	A plant-specific aging management program is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging.	Yes	Not applicable	Not Applicable (See SER Section 3.2.2.2.6)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled (internal) (3.2.1-13)	Loss of material due to general corrosion and fouling	A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not applicable to PWRs (See 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)
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 (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	Not applicable	Not Applicable (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 microbiologically -influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	Yes	Not applicable	Not Applicable (See SER Section 3.2.2.2.9)
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.2.1-18)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Not applicable	Not applicable to PWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to steam or treated water (3.2.1-19)	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Not applicable	Not applicable to PWRs
Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated water (borated or unborated) > 250°C (> 482°F) (3.2.1-20)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (B.2.41)	Consistent with the GALL Report
High-strength steel closure bolting exposed to air with steam or water leakage (3.2.1-21)	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
Steel closure bolting exposed to air with steam or water leakage (3.2.1-22)	Loss of material due to general corrosion	Bolting Integrity	No	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
Steel bolting and closure bolting exposed to air - outdoor (external), or air - indoor uncontrolled (external) (3.2.1-23)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Bolting Integrity Program (B.2.6)	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	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water > 60°C (> 140°F) (3.2.1-25)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Not applicable	Not Applicable (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 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 (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-Cycle Cooling Water System (B.2.9)	Consistent with the GALL Report
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water (3.2.1-28)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System (B.2.9)	Consistent with the GALL Report
Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.2.1-29)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
Stainless steel and copper alloy heat exchanger tubes exposed to closed cycle cooling water (3.2.1-30)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System (B.2.9)	Consistent with the GALL Report
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 Surface Monitoring (B.2.15)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping and ducting components and internal surfaces exposed to air - indoor uncontrolled (Internal) (3.2.1-32)	Loss of material due to general corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22) and Fire Water System (B.2.17)	Consistent with GALL Report (See SER Section 3.2.2.1.3)
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 (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 (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 microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
Steel heat exchanger components exposed to raw water (3.2.1-36)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System (B.2.32)	Consistent with the GALL Report
Stainless steel piping, piping components, and piping elements exposed to raw water (3.2.1-37)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Open-Cycle Cooling Water System	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	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 containment isolation piping and components internal surfaces exposed to raw water (3.2.1-38)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
Stainless steel heat exchanger components exposed to raw water (3.2.1-39)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System (B.2.32)	Consistent with the GALL Report
Steel and stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water (3.2.1-40)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System (B.2.32)	Consistent with the GALL Report
Copper alloy > 15% Zn piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.2.1-41)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not Applicable (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	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
Gray cast iron piping, piping components, and piping elements exposed to soil (3.2.1-43)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable	Not Applicable (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 (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
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 (B.2.7)	Consistent with GALL Report
Steel encapsulation components exposed to air with borated water leakage (internal) (3.2.1-46)	Loss of material due to general, pitting, crevice and boric acid corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated borated water > 250°C (> 482°F) (3.2.1-47)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (B.2.41)	Consistent with the GALL Report
Stainless steel or stainless-steel-clad steel piping, piping components, piping elements, and tanks (including safety injection tanks/accumulators) exposed to treated borated water > 60°C (> 140°F) (3.2.1-48)	Cracking due to stress corrosion cracking	Water Chemistry	No	Water Chemistry (B.2.42)	Consistent with the GALL Report
Stainless steel piping, piping components, piping elements, and tanks exposed to treated borated water (3.2.1-49)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry (B.2.42)	Consistent with the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Aluminum piping, piping components, and piping elements exposed to air - indoor uncontrolled (internal/external) (3.2.1-50)	None	None	No	None	Consistent with the GALL Report
Galvanized steel ducting exposed to air - indoor controlled (external) (3.2.1-51)	None	None	No	Not applicable	Not Applicable (See SER Section 3.2.2.1.1)
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 (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 the 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 (See SER Section 3.2.2.1.1)
Steel and stainless steel piping, piping components, and piping elements in concrete (3.2.1-55)	None	None	No	None	Consistent with the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to gas (3.2.1-56)	None	None	No	None	Consistent with the GALL Report
Stainless steel and copper alloy < 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-57)	None	None	No	None	Consistent with the GALL Report

The staff's review of the ESF component groups followed any one of several approaches. One approach, documented in SER Section 3.2.2.1, 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 3.2.2.2, 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 3.2.2.3, 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 ESF components is documented in SER Section 3.0.3.

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-Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- One-Time Inspection Program
- Open-Cycle Cooling Water System Program
- Water Chemistry Program

LRA Tables 3.2.2-1 through 3.2.2-3 summarizes AMRs for the ESF components and indicates AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency 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 line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

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

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

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

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the engineered safety features ESF 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 3.2.1, 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 had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the subsections that follows.

3.2.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.2.1, item 2, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS does not have steel with stainless steel cladding pump casings in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS does not have steel with stainless steel cladding pump casings in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, items 3, and 15, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS AMR line items roll up to this item. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that the internal surfaces of stainless steel containment isolation piping and components exposed to treated water were evaluated in the tables associated with their parent system and did not roll-up to this line item. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, items 6, and 9, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS components in the ESF systems align to this item. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that no BVPS components in the ESF systems align to this item. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 7, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because the BVPS RWST tanks are evaluated with their bottom surfaces in contact with soil, and align to item 3.2.1-04. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that RWST tanks align to item 3.2.1-04. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 12, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS AMR line items roll up to this item. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that the BVPS high pressure safety injection pump miniflow orifices are evaluated in the Chemical and Volume Control System (3.3.2.1.5) and compared to NUREG-1801 in the auxiliary Systems Chapter. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 21, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS does not have high strength closure bolting in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS does not have high strength closure bolting in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 22, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no in-scope steel closure bolting exposed to air with steam or water leakage in the ESF System. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no in-scope steel closure bolting exposed to air with steam or water leakage in the ESF System. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 24, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS did not identify loss of preload as an aging effect for closure bolting. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS did not identify loss of preload as an aging effect for closure bolting. BVPS assigned the Bolting Integrity (B.2.6) program to manage aging on in-scope bolting. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 25, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no in-scope stainless steel piping exposed to closed cycle cooling water >60 degrees C (>140 degrees F) in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no in-scope stainless steel piping exposed to closed cycle cooling water >60 degrees C (>140 degrees F) in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 26, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no in-scope steel piping exposed to closed cycle cooling water in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no in-scope steel piping exposed to closed cycle cooling water in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 29, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no in-scope copper alloy components exposed to closed cycle cooling water in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no in-scope copper alloy components exposed to closed cycle cooling water in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 33, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS components in the ESF systems align to this item. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that no BVPS components in the ESF systems align to this item. The encapsulations for valves in the Containment Depressurization System (3.2.2.1.1) are fabricated of stainless steel, and are evaluated as integral parts of the valves. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 34, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no in-scope steel components exposed to condensation (internal) in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no in-scope steel components exposed to condensation (internal) in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, items 35, and 38, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS AMR line items roll up to this item. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed that the internal surfaces of Containment Isolation piping and components exposed to raw water were evaluated in the tables associated with their parent system and did not roll-up to this line item. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 41, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no in-scope copper alloy >15% Zn components exposed to closed cycle cooling water in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no in-scope copper alloy >15% Zn components exposed to closed cycle cooling water in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, items 42-44 the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no in-scope gray cast iron components exposed to closed cycle cooling water in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no in-scope gray cast iron components exposed to closed cycle cooling water in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, item 46 the applicant states that the corresponding AMR result line in the GALL Report is not applicable because the BVPS encapsulations for valves in the Engineered Safety Systems are fabricated of stainless steel, and are evaluated as integral parts of the valves. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that the encapsulations for valves in the Engineered Safety Systems are fabricated of stainless steel, and are evaluated as integral parts of the valves. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, items 51 the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no in-scope galvanized steel components exposed to air-indoor controlled environment in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no in-scope galvanized steel components exposed to air-indoor controlled environment in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, items 52 the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no glass components in the ESF systems that are subject to aging management review. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no in-scope galvanized steel components exposed to air-indoor controlled in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.2.1, items 54 the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS has no in-scope steel components exposed to air-indoor controlled environment in the ESF Systems. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no in-scope galvanized steel components exposed to air-indoor controlled in the ESF Systems. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

3.2.2.1.2 Loss of Material in ESF Components Exposed to Raw Water

In AMR items 88 and 89 of LRA Table 3.2.2-1, the applicant includes two AMRS to manage loss of material of cast austenitic stainless steel BVPS Unit 1 inside recirculation spray pump casings, one the internal pump casing surfaces that are exposed to raw water and one for external pump casing surfaces that are exposed to raw water. In these AMRs, the applicant credited AMP B.2.22, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to pitting and crevice corrosion. During its review, the staff noted that the applicant’s AMRs for this component referenced GALL AMR V.D1-25 and applied Note E to these internal and external AMR items because the applicant was crediting an AMP that was different from an AMP corresponding to GALL AMP XI.M20, “Open Cycle Cooling Water,” which is the AMP recommended for aging management in GALL AMR V.D1-25.

The staff reviewed the AMR results provided for these recirculation spray pump casings. The staff noted that in the applicant’s scoping result Section for these pump casings, as provided in

LRA Section 2.3.2.1, the applicant clearly identifies that internal environment for the recirculation spray system, which includes recirculation spray pumps, is the borated treated water environment from the containment sump and that the applicable external environment for these pump casings in the containment atmosphere. The staff noted that, for these pump casing components, applicant normally would have provided an AMR in the application that identified borated treated water as the internal environment and that referenced either GALL AMR item V.A-27 or V.D1-30 as the applicable GALL-based AMR, which is on management of loss of material due to pitting and crevice corrosion in PWR stainless steel (including CASS) components under exposure to a borated water treated environment. However, the staff noted that the applicant conservatively treats the internal environment for the pump casings as raw water environment because the sump is an open system and is exposed to the containment atmosphere, which can potentially lead to the ingress of oxygen into sump water.

Thus, based on its review, the staff found that the identification of raw water as the applicable internal environment for the pump casings to be conservative and acceptable, and that as a result of this conservatism, found the applicant's referencing of GALL AMR item V.D1-25 to be appropriate for the management of loss of material in the internal pump casing surfaces. The staff also noted that it would not be appropriate to credit the LRA AMP B.2.32, Open-Cycle Cooling Water System Program for aging management of the internal pump casing surfaces because the sump and the recirculation spray system piping, piping components, and piping elements aligned to the sump are not within the River Water/Service (Open-Cycle Cooling Water) systems. Instead the staff concluded that the crediting of AMP B.2.22, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, was an acceptable AMP to credit for the management of loss of material in the internal pump casing surfaces because this program was consistent with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," and because this program credits and will implement periodic visual inspections of the internal component surfaces for evidence of corrosion or loss of material. The staff evaluation of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and the staff's basis for approving this AMP to manage loss of material in the internal surfaces of miscellaneous piping and duct components (including these pump casings) is given in SER Section 3.0.3.1.12.

The staff noted that, for the BVPS Unit 1 recirculation spray pump casing components, BVPS Unit 1 UFSAR indicates that the pumps are submerged in the sump and thus are exposed externally to the raw water environment of the sump water. The staff noted that this was a unique design feature of the Unit 1 recirculation spray pumps, the external surfaces of the pumps are contained within the location of the sump walls and are accessible. As a result of this, the applicant considers these wall surfaces to be component surfaces internal to the sump walls and are accessible for the visual examinations that are credited under the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. In GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping And Ducting Components," the staff states that the program is valid to use for the monitoring of loss of material in internal surfaces of steel piping, piping components, ducting, and other components that are not covered by other aging management programs. In this AMP, the staff credits the visual inspections to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions, with the added clarification that a plant-specific program should be credited if visual inspection of component surfaces is not possible. Based on this review, the staff finds that the applicant has provided a valid basis for crediting the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for managing loss of material in the BVPS Unit 1 inside recirculation spray pump casing surfaces because they are located internally to the sump wall and because, consistent with the staff's basis in GALL AMP XI.M38, they are accessible to the visual examination methods that are credited under this AMP.

In LRA Table 3.2.1, item 37, the applicant stated that loss of material of stainless steel piping, piping components, and piping elements exposed to raw water is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that LRA Table 3.2.1, item 37 is referenced in Table 3.3.2-1, Containment Depressurization System and the applicant applied Note E to these items. The applicant referenced GALL Report item V.D1-25 for these items. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant also applied Note 207 to these components indicating that this raw water environment is associated with aerated drains within a sump pit and the Open-Cycle Cooling Water System program is not applicable to this environment.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to which the applicant program is consistent, addresses only internal surfaces of steel piping, the aging mechanism of pitting, crevice or microbiologically induced corrosion show similar characteristics for all metallic materials and are amenable to the same types of visual inspections. Thus, corrosion on stainless steel and cast stainless steel internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to pitting, crevice and microbiologically induced corrosion in stainless steel piping, piping components, and piping elements exposed to raw water.

Based on its review of AMR result lines and recommendations in the GALL Report, the staff finds that the applicant addressed the aging effects management adequately, as recommended by the GALL Report.

3.2.2.1.3 Loss of material due to General Corrosion of Piping and Ducting Components Exposed to Uncontrolled Indoor Air

In LRA Table 3.2.1, item 32, the applicant stated that loss of material of steel piping, and ducting components and internal surfaces exposed to air-indoor uncontrolled (internal) environment is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program or the Fire Water System Program.

The staff noted that LRA Table 3.2.1, item 32 is referenced in Table 3.3.2-18, Fire Protection System and the applicant applied Note E to these items. The applicant referenced GALL Report item V.A-19 for these components. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," the applicant proposed using the Fire Water System Program. The applicant also applied Note 318 to these items indicating that these components are associated with the fire water system.

The Fire Water System Program is consistent with the GALL AMP XI.M27, “Fire Water System.” The applicant has enhanced the program to require a representative number of fire water piping locations be identified if piping visual inspections are used as an alternative to nonintrusive testing. The program is also enhanced to add a program requirement to perform a fire water subsystem internal inspection any time a subsystem (including fire pumps) is breached for repair or maintenance. The Fire Water System Program evaluation is documented in SER Section 3.0.3.2.6. The GALL AMP XI.M38 recommends periodic visual inspection of internal surfaces during surveillance testing or preventive maintenance activities. On the basis that the Fire Water System Program will be performing periodic visual inspection activities and/or wall thickness measurements, the staff finds that the applicant’s use of the Fire Water System Program is acceptable.

Based on its review of AMR result lines and recommendations in the GALL Report, the staff finds that the applicant addressed the aging effects management adequately, as recommended by the GALL Report.

SER Section 3.2.2.1 Conclusion: The staff evaluated the applicant’s claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant’s consideration of recent operating experience and proposals for managing 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 with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.2.2.2, 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
- loss of material due to pitting and crevice corrosion
- reduction of heat transfer due to fouling
- hardening and loss of strength due to elastomer degradation

- loss of material due to erosion
- loss of material due to general corrosion and fouling
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion
- 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 audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.2.2.2.The staff's review of the applicant's further evaluation follows.

3.2.2.2.1 Cumulative Fatigue Damage

LRA Section 3.2.2.2.1 states that management of cumulative fatigue damage in the emergency safety feature ESF components is accomplished as a TLAA, as defined in 10 CFR 54.3. In this LRA section, the applicant states that the TLAA analysis for these components is given in LRA Section 4.3.

SRP-LR 3.2.2.2.1 identifies that management of cumulative fatigue damage is ESF components is to be accomplished as a TLAA that meets the definition of a TLAA in 10 CFR 54.3. The SRP-LR Section states that analyzed states that the applicant must evaluate its TLAA for these components in accordance with 10 CFR 54.21(c)(1). SRP-LR references AMR item 1 in Table 2 of the GALL Report, Volume 1, as applicable to the management of cumulative fatigue damage in ESF components.

The staff verified that LRA Table 3.2.1 includes AMR item 3.2.1-01 on management of cumulative fatigue damage in steel and stainless steel ESF piping, piping components, and piping elements. The staff verified that in this AMR the applicant identified that it manages cumulative fatigue damage of the ESF piping, piping components, and piping elements in accordance with the TLAA that is provided in LRA Section 4.3. The staff also verified that the applicant provides its TLAA for these components in LRA Section 4.3.2, "Non-Class 1 Fatigue," which provides the applicant's TLAA Section for non-ASME Code Class 1 components. The staff finds the applicant's aging management basis to be acceptable because it is in conformance with the recommendations in SRP-LR Section 3.2.2.2.1 and in AMR item 1 in Table 2 of the GALL Report, Volume 1. The staff documents its evaluation of the applicant's TLAA for non-Class 1 components in SER Section 4.3.2.

3.2.2.2.2 Loss of Material Due to Cladding

SRP-LR Section 3.2.2.2.2 identifies that loss of material due to cladding breach may occur in PWR steel pump casings with stainless steel cladding exposed to treated borated water and recommends further evaluation of a plant-specific AMP to ensure that aging effect is managed.

LRA Section 3.2.2.2.2 identifies that loss of material due to cladding breach may occur in PWR steel pump casings with stainless steel cladding exposed to treated borated water and recommends further evaluation of a plant-specific AMP to ensure that aging effect is managed.

LRA Section 3.2.2.2.2 invokes the AMR Item 2 in Table 2 of the GALL Report, Volume 1 and AMR Item V.D1-32 of the GALL Report, Volume 2 on management of loss of material due to cladding in steel with stainless steel cladding pump casings that are exposed to a treated borated water environment.

The applicant stated that the charging pumps at BVPS are fabricated from austenitic stainless steel and not from carbon steel with stainless steel cladding. These charging pumps are evaluated within the auxiliary systems in LRA Table 3.3.2-5. The staff confirmed that these charging pumps are included in the AMR Table 3.3.2-5 and have an aging evaluation performed. The applicant has credited water chemistry and one-time inspection programs to manage the aging effect of loss of material for these stainless steel pump casings. However, the staff concludes that loss of material due to cladding breach is not applicable to BVPS because the charging pumps are fabricated from austenitic stainless steel and not from carbon steel with stainless steel cladding.

3.2.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

Internal Surfaces of Stainless Steel Containment Isolation Components. LRA Section 3.2.2.2.3.1 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.2.2.2.3.1, "Loss of Material Due to Pitting and Crevice Corrosion, Internal Surfaces of Stainless Steel Containment Isolation Components," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that loss of material due to pitting and crevice corrosion could occur in the stainless steel containment isolation components as a result of exposure of their internal surfaces to treated water. The applicant states that, instead of having one system commodity group addressing containment isolation components, the applicant has opted to evaluate loss of material due to pitting and crevice corrosion under their AMRs for their parent systems. The applicant states that, if loss of material due to pitting and crevice corrosion is applicable, an appropriate aging management program is credited.

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 sections states that the existing AMP relies on monitoring and control of water chemistry to mitigate degradation, but qualifies this statement by clarifying that the control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. Therefore, the SRP-LR Section states that the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring, and that as a result of this, the GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. The SRP-LR Section indicates 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.

SRP-LR Section 3.2.2.2.3, Item (1) refers to AMR Item 3 in Table 2 of the GALL Report, Revision 1, Volume 1 (GALL1), and AMR item V.C-4 in the GALL Report, Revision 1, Volume 2 (GALL2), as applicable to the management of loss of material due to pitting and crevice corrosion in the internal surfaces of stainless steel containment isolation piping, piping components, and piping elements that are exposed to treated water. The recommendations in the GALL-based AMR items are consistent with the guidance in SRP-LR Section 3.2.2.2.3, Item (1).

The staff reviewed LRA Section 3.2.2.2.3.1 on management of loss of material due to pitting and crevice corrosion in the BVPS stainless steel containment isolation piping, piping components, and piping elements against the staff's recommended regulatory criteria in SRP-LR Section 3.2.2.2.3, Item (1); AMR Item 3 in Table 2 of the GALL Report, Volume 1; and AMR V.C-4 in the GALL Report, Volume 2.

The staff noted that, although the applicant had indicated that the AMRs on loss of material due to pitting and crevice corrosion of stainless steel containment isolation piping components would be handled by the Type "2" AMR tables for their parent system, the AMRs on loss of material in these tables did not specifically identify which of the AMR items specifically covered these containment isolation components. Thus, the staff found that the applicant's "further evaluation" of loss of material of these containment isolation components left a gap in the LRA on which specific containment isolation component commodity groups the applicant was referring to and which LRA AMR items covered loss of material in these components.

In RAI 3.2.2.2.3.1-1, the staff asked the applicant to identify which of AMRs in LRA Tables 3.2.2-1 though 3.2.2-3, LRA Tables 3.3.2-1 through 3.3.2-32, and LRA Tables 3.4.2-1 through 3.4.2-10, if any, specifically covered the scope of the stainless steel containment isolation components that were addressed in LRA Section 3.2.2.2.3.1.

The applicant responded to RAI 3.2.2.2.3.1-1 in a letter dated July 21, 2008. In this response, the applicant explained that LRA Section 3.2.2.2.3.1 and Table 3.2.1, Item 3.2.1-03, address loss of material for stainless steel containment isolation piping and components internal surfaces that are exposed to treated water. The applicant further explained that the only GALL Report Volume 2 row that aligns to GALL Report Volume 1 Table 2, Item 3, and to Further Evaluation 3.2.2.2.3.1, is row V.C-4. The applicant stated that this row recommends that loss of material by GALL Report Section XI.M2, "Water Chemistry," program, augmented by verification of effectiveness with the Section XI.M32, "One-Time Inspection," program. The staff reviewed the Volume 1 and Volume 2 of the GALL Report and finds this accurate.

The applicant further explained that BVPS has no system that consolidates containment isolation components. Further, Section V.C does not address some materials, environments, and aging effects associated with containment penetrations such as copper in compressed air systems. Based on this, the applicant did not consider GALL Report Section V.C, as a comprehensive reference Section for aging evaluation comparisons, and used other GALL Chapters for aging comparisons of piping elements.

Finally, the applicant stated that the GALL Report contains eighteen other rows in Sections IV, V, VII and VIII that address loss of material for stainless steel components in treated water. In each case, the GALL Report recommends the XI.M2, "Water Chemistry," and XI.M32, "One-Time Inspection," programs. The applicant explained that for each instance of a stainless steel component in the “Treated water,” “Treated water >60°C (>140°F),” or “Treated water >250°C (>482°F)” environments in LRA Sections 3.1, 3.2, 3.3, and 3.4, the BVPS Water Chemistry and One-Time Inspection Programs with management of loss of material. The applicant concluded that the containment penetration components in various systems that would have been compared to GALL Report row V.C-4, for consistency with material, environment, and aging effect, are consistent with the recommendations of the GALL Report and SRP-LR Section 3.2.2.2.3.1, for the assigned aging management programs.

The staff reviewed the applicant’s response and finds that, even though the response did not identify all of the containment isolation components whose AMRs were aligned to GALL AMR item V.C-4, the staff found that the response was adequate because it clarified that the applicant was aligning all of the AMRs in LRA Section 3.2, 3.3, and 3.4 on loss of material in BVPS stainless steel containment isolation penetrations under exposure to either a “treated water,” “treated water >60°C (>140°F),” or “treated water >250°C (>482°F)” environment to GALL AMR item V.C-4, and that for these components the applicant is crediting its Water Chemistry Program to manage loss of material due to pitting and crevice corrosion in the component surfaces that are exposed to these environments and the One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing the aging effect. The staff finds this to be acceptable because it is in conformance with the recommended aging management criteria in SPR-LR Section 3.2.2.2.3.1 and in GALL AMR V.C-4. RAI 3.2.2.2.3.1-1 is resolved.

Based on the programs identified above, the staff concludes that the applicant’s programs meet SRP-LR Section 3.2.2.2.3, Item (1) criteria. For those line items that apply to LRA Section 3.3.2.2.3.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Buried Stainless Steel Components. LRA Section 3.2.2.2.3.2 addresses the applicant’s evaluation on whether the recommended guidance in SRP-LR Section 3.2.2.2.3, Item (2), “Loss of Material Due to Pitting and Crevice Corrosion, *Buried Stainless Steel Components*,” is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that, for the purpose of the GALL Report comparison, loss of material due to pitting and crevice corrosion in BWR stainless steel piping components was determined to also be applicable to PWR systems with treated (unborated) water. In this Section of the LRA, the applicant stated that loss of material due to pitting and crevice corrosion is possible for stainless steel piping, piping components, and piping elements exposed to soil. The applicant also stated that the bottom surfaces of the stainless steel RWSTs at both units rest on concrete pads and that these bottom surfaces are protected by construction or treatment methods intended to preclude water from contacting the tank bottoms. However, for a conservative aging evaluation, the applicant stated that the stainless steel tank bottoms are assumed to be exposed to water, and that the environment for the exterior of the tank bottom is conservatively evaluated as "Soil" to account for the potentially wetted environment. The applicant stated that One-Time Inspection Program (Section B.2.30) is credited to provide confirmation that loss of material due to microbiologically-influenced corrosion (MIC) and due to crevice and/or pitting corrosion is not occurring in the external bottom surfaces of the stainless steel RWSTs.

SRP-LR Section 3.2.2.2.3, Item (2) states that loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The SRP-LR Section states that the GALL Report recommends that further evaluation of a plant-specific AMP be performed to ensure that the aging effect is adequately managed. The SRP-LR Section states that the acceptance criteria for any program credited with aging management of this aging effect are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR).

For PWR designs, SRP-LR Section 3.2.2.2.3, Item (2) refers to AMR Item 4 in Table 2 of the GALL Report, Revision 1, Volume 1 (GALL1), and AMR item V.D1-26 in the GALL Report, Revision 1, Volume 2 (GALL2), as applicable to the management of loss of material due to pitting and crevice corrosion in the external surfaces of stainless steel piping, piping components, and piping elements that are exposed to a soil environment. The AMR guidance in these GALL-based AMRs is consistent with the guidance that is provided in SRP-LR Section 3.2.2.2.3, Item (2).

The staff reviewed the LRA and verified that the applicant did not include any AMRs in LRA Tables 3.2.2-1, 3.2.2-2 or 3.2.2-3 pertaining to management of loss of material in stainless steel ESF piping, piping components, or piping elements under exposure to a soil environment. The staff verified that as conservatism for the LRA, the applicant included an AMR on loss of material due to pitting and crevice corrosion for the external stainless steel bottom surfaces of the RWSTs at the units. The staff noted that although these stainless steel tanks sit up on and are supported by concrete pads, the applicant has treated the bottom surfaces of these components as if they were exposed to a soil environment to account for the possibility that the external stainless steel bottom surfaces may be damp or wet. The staff noted that for these bottom RWST surfaces, the applicant credited its One-Time Inspection Program to manage loss of material in the external bottom surfaces of the tanks.

The staff noted that GALL AMP XI.M32, “One-Time Inspection,” indicates that one-time inspection program are valid programs to credit for cases where: (a) an aging effect is not expected to occur but the data is insufficient to rule it out with reasonable confidence; (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected; or (c) the characteristics of the aging effect include a long incubation period. The AMRs in GALL2 Table V.F indicate that stainless steel components are resistant to corrosive effects in moist or damp environments. Therefore, the staff concludes that the applicant has provided an acceptable basis for crediting its One-Time Inspection Program to manage loss of material in the external stainless steel surfaces of the RWSTs because, consistent with the AMRs provide for stainless steel components in GALL2 AMR Table V.F, corrosion or loss of material is not expected to occur on the external surfaces of these tanks.

Based on the programs identified above, the staff concludes that the applicant’s programs meet SRP-LR Section 3.2.2.2.3, Item (2) criteria. For those line items that apply to LRA Section 3.3.2.2.3.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

BWR Stainless Steel and Aluminum Piping. LRA Section 3.2.2.2.3.3 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.2.2.2.3.3, "Loss of Material Due to Pitting and Crevice Corrosion, *BWR Stainless Steel and Aluminum Piping*," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that, for the purpose of the GALL Report comparison, loss of material due to pitting and crevice corrosion in BWR stainless steel piping components was determined to also be applicable to PWR systems with treated (unborated) water.

In LRA Section 3.2.2.2.3.3, the applicant states that it conservatively concluded that the BVPS Unit 1 chemical addition pumps and BVPS Unit 1 and 2 chemical addition pumps are internally exposed to a treated NaOH environment that the BVPS conservatively considers this to be the equivalent of the BWR treated water environment addressed in SRP-LR Section 3.2.2.2.3.3, and that, for the purpose of this comparison, the Nickel-alloy materials in these components was considered to be the equivalent of stainless steel. The applicant states that it conservatively considers loss of material due to piping and crevice corrosion to be a potential aging effect requiring management for these components, and credits a combination of its Water Chemistry Program to manage loss of material in component surfaces that are exposed to the treated water environment and its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing this aging effect.

SRP-LR Section 3.2.2.2.3, Item (3) states that loss of material from pitting and crevice corrosion could occur for BWR stainless steel and aluminum piping, piping components, and piping elements exposed to treated water. The existing AMP relies on monitoring and control of water chemistry for BWRs to mitigate degradation. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the 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. 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."

SRP-LR Section 3.2.2.2.3, Item (3) refers to AMR Item 5 in Table 2 of the GALL Report, Revision 1, Volume 1 (GALL1), and AMR item V.D2-19 and V.D2-28 in the GALL Report, Revision 1, Volume 2 (GALL2), as applicable to the management of loss of material due to pitting and crevice corrosion in the internal surfaces of aluminum or stainless steel BWR emergency core cooling system piping, piping components, and piping elements that are exposed to treated water. The recommendations in these GALL-based AMR items are consistent with the guidance in SRP-LR Section 3.2.2.2.3, Item 3.

The staff noted that, although the staff's recommendations in SRP-LR Section 3.2.2.2.3.3 are applicable only to the evaluation of loss of material in aluminum or stainless steel BWR emergency safety feature (ESF) piping, piping components, and piping elements, the applicant conservatively decided to use this SRP-LR Section to further evaluate the potential for loss of material to occur in the BVPS emergency safety features that are exposed to a treated NaOH-based water environment (i.e., a hydroxide-based alkaline water environment). The staff also noted that consistent with this SRP-LR guidance, the applicant credits its Water Chemistry Program to manage loss of material due to pitting and crevice corrosion in the BVPS chemical injection/addition pumps that are exposed to a treated NaOH-based water environment and its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing this aging effect.

In RAI 3.2.2.2.3.3-1, the staff asked the applicant to: (1) clarify why the NaOH-based treated water environment was considered to be the equivalent of the BWR treated water environment addressed in SRP-LR Section 3.2.2.2.3.3, and (2) clarify why the AMR for managing loss of material due to pitting and crevice corrosion in the stainless steel components was limited only the chemical injection or addition pumps that are exposed to the NaOH-based treated water.

The applicant responded to RAI 3.2.2.2.3.3-1 in a letter dated July 21, 2008. In this response, the applicant explained that the GALL Report Section IX.D, “Selected Definitions and Use of Terms for Describing and Standardizing Environments,” describes “Treated water” as demineralized water, which is the base water for all clean systems in BWRs and PWRs. Further, the applicant further explained that the Electric Power Research Institute (EPRI) document EPRI-1010639 “Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools,” (EPRI Mechanical Tools) indicates that the common alkalis, such as caustic soda (sodium hydroxide – NaOH), are not particularly corrosive. The applicant clarified that aging effects for components that are exposed to sodium hydroxide solution are no different than those for components that are exposed to other water treatment environments, with the exception that now, caustic corrosion is potentially an additional mechanism that could induce loss of material in the components and that caustic cracking is potentially an additional mechanism that could induce cracking in the components.

The applicant clarified that the potential for caustic corrosion and caustic cracking is dependent upon both temperature and concentration of the NaOH, and that austenitic stainless steels are very resistant to caustic corrosion in NaOH concentrations up to 50% by weight. The applicant clarified that austenitic stainless steels are susceptible to caustic cracking when exposed to NaOH solutions whose NaOH concentrations exceed 25% by weight and whose temperatures are above 212°F. The applicant confirmed that NaOH concentrations do not exceed 25% in the BVPS Containment Depressurization System, and operating temperatures of the tanks do not exceed 125°F. Therefore, based on this determination, the applicant concluded that neither caustic corrosion nor caustic cracking are aging effects requiring management for the components exposed to NaOH, and the aging effects for components exposed to the solution are equivalent to those for other treated water environments.

However, the applicant also concluded that, since the aging effects for the selected components exposed to the NaOH solution are equivalent to those for other treated water environments, then the comparison to the BWR treated water environment is considered to be acceptable. For these components that are subject to an NaOH treated water environment, the applicant concluded that the applicable aging effects of loss of material due to pitting and crevice corrosion are applicable to the component surfaces that are exposed to the NaOH treated water environment, and that the AMRs for these component align to GALL AMR item V.D2-28 and to LRA AMR item 3.2.1-15 and to AMR Item 15 in Table 2 of the GALL Report, Volume 1. The applicant clarified that, as a result of the alignment of these AMRs to AMR Item 15 in Table 2 of the GALL Report, Volume 1, the staff’s guidance in SRP-LR Section 3.2.2.2.3.3 is applicable to these AMRs.

In its letter dated July 21, 2008, the applicant also explained the AMR results in LRA Table 3.2.2-1 that link to Section 3.2.2.2.3.3 through LRA Table 3.2.1-5 are not limited only to stainless steel chemical injection or addition pumps that are exposed to NaOH-treated water. The first paragraph of LRA Section 3.2.2.2.3.3 was intended to address all treated water environments that are compared to the GALL Report, row V.D2-28, and which link to LRA Section 3.2.2.2.3.3 via Table 3.2.1-5, not just the NaOH-treated water environment. The applicant further explained that the LRA was intended to provide clarification for what a reviewer might consider to be an unusual match (i.e., the NaOH environment), and does not list all component types exposed to the NaOH-treated water environment. The applicant stated that the piping, valve body and tank components in the Chemical Addition / Chemical Injection subsystem are also exposed to NaOH treated water.

In LRA Amendment 17, dated July 21, 2008 LRA Section 3.2.2.2.3.3 was revised to clarify that the comparison includes stainless steel piping components exposed to treated (unborated) water containing sodium hydroxide (NaOH) solution and that this GALL Report environment was used for comparison because no corresponding row existed for PWRs. In LRA Amendment 17, the applicant also clarified that the Unit 1 and Unit 2 Chemical Addition Subsystems (including piping, pump casing, tank, and valve body component types) have an internal fluid of NaOH solution, in addition to just the originally identified chemical injection and chemical addition pumps.

The staff reviewed the applicant’s response, EPRI 1010639, and Amendment 17 and finds that the applicant has conservatively considered the NaOH environments to be comparable to the treated water environment for BWR-designed plants, and that the guidance in SRP-LR Section 3.2.2.2.3.3 is applicable to the stainless steel components exposed to an environment of NaOH. In this case, the applicant’s Water Chemistry is program is designed to manage the amount of NaOH that might induce caustic stress corrosion-induced cracking of the components if the pH of the treated water gets to high (i.e. a basic pH value) and the applicant One-Time Inspection Program will be used to verify that the applicant’s Water Chemistry Program is achieving its mitigative aging management function to manage this aging effect. The staff finds this to be acceptable because it is in conformance with the guidance and AMPs recommended in SRP-LR Section 3.3.2.2.3.3 and in GALL AMR IV.D2-28 for managing stress-corrosion induced cracking in stainless steel components.

The staff noted that, in LRA Table 3.2.2-1, “Containment Depressurization System – Summary of Aging Management Evaluation,” the applicant also aligned its AMRs for managing loss of material due to general, pitting, and crevice corrosion of the stainless steel piping (including any containment isolation piping) to SRP-LR Section 3.2.2.2.3.3 and to GALL AMR item IV.D2-28. The staff noted that the applicant conservatively considered the non-borated treated water environment in these AMRs to the treated water environment for BWR-designed plants (which except for treated water in standby liquid control systems is non-borated. For these AMRs, the staff noted that the applicant conservatively credits its Water Chemistry Program to manage loss of material in the piping, and its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing this aging effect. The staff finds that the applicant’s basis for managing loss of material in the stainless steel containment depressurization system piping is acceptable because it is in conformance with the guidelines in SRP-LR Section 3.2.2.2.3.3 and in GALL AMR V.D2-28.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3, Item (3) criteria. For those line items that apply to LRA Section 3.3.2.2.3.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Stainless Steel and Copper Alloy Piping Components In Lubricating Oil. In LRA Section 3.2.2.2.3.4, the applicant states that loss of material from pitting and crevice corrosion could occur for stainless steel, and copper alloy piping, piping components, and piping elements exposed to lubricating oil. The applicant clarified that BVPS has no components in this category in the ESF systems Section and that the applicable BVPS components exposed to lubricating oil are associated with the high-head safety injection/charging pumps. The high-head safety injection/charging pump subcomponents exposed to lubricating oil are evaluated in the Chemical and Volume Control System (CVCS). The applicant stated that further evaluation of CVCS component AMRs are provided in LRA Section 3.3.2.2.10.4 and LRA Section 3.3.2.2.12.2, and in the Table 2 AMR items that roll up to AMR items 3.3.1-26 and 3.3.1-33 in LRA Table 3.3.1.

SRP-LR Section 3.2.2.2.3, Item (4) states that loss of material from pitting and crevice corrosion could occur for stainless steel and copper alloy emergency safety feature (ESF) piping, piping components, and piping elements exposed to lubricating oil. In this Section the staff states that the existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, the staff qualifies this statement by clarifying that control of lube oil contaminants may not always have been adequate to preclude corrosion, and that therefore the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The SRP-LR Section identifies that the GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil program, and that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

For PWR designs, the AMRs in the GALL Report which are referenced by SRP-LR Section 3.2.2.2.3, Item (4) are AMR item 6 in Table 2 of the GALL Report, Revision 1, Volume 1 (GALL1) and AMR items V.A1-21, V.D1-18, and V.D1-24, as applicable to management of loss of material in ESF stainless steel and copper alloy piping, piping components, and piping elements in emergency core cooling systems and containment spray systems under exposed to a lubricating oil environment. The recommendations in these GALL AMRs are consistent with the guidance in SRP-LR Section 3.2.2.2.3, Item (4).

The staff noted that the applicant indicated that the BVPS designs do not have any stainless steel or copper alloy components in ESF systems that are exposed to a lubricating oil environment. The staff also noted that the applicant also indicated that the applicable BVPS stainless steel components that are exposed to lubricating oil are the high-head safety injection pumps, which are within the scope of the applicant's chemical and volume control (CVCS) system, and that its AMRs for managing loss of material in the surfaces of high-head safety injection/charging pump subcomponents under exposure to lubricating oil are given and evaluated in LRA Table 3.3.2-5, "Chemical and Volume Control System - Summary of Aging

Management Review." The staff evaluates the Table 2 AMRs on loss of material in the stainless steel CVCS charging pump surfaces under exposure to a lubricating oil environment (which roll up to AMRs items 3.3.1-26 and 3.3.1-33 in LRA Table 3.3.1) in SER Section 3.3.2.2.10.4 and SER Section 3.3.2.2.12.2.

The staff reviewed the AMR line items for the ESF components and verified that LRA Tables 3.2.2-1, 3.2.2-2, and 3.2.2-3 did not include any AMRs that identified that there were ESF components that are exposed to a lubricating oil environment or that aligned to AMR item 6 in Table 2 of the GALL Report, Revision 1, Volume 2 or to LRA AMR item 3.2.1-06. Therefore, the staff finds that the applicant has provided an acceptable basis for concluding that the AMR guidance in SRP-LR Section 3.2.2.2.3, Item (4) is not applicable to the BVPS LRA because the staff has verified that the ESF systems do not include any stainless steel or copper alloy components that are exposed to a lubricating oil environment.

Based on the staff's review, the staff concludes that SRP-LR Section 3.2.2.2.3, Item (4) is not applicable to the BVPS LRA because the staff has verified that the ESF systems do not include any stainless steel or copper alloy components that are exposed to a lubricating oil environment.

Bottom Surfaces of Stainless Steel Tanks. In LRA Section 3.2.2.2.3.5, the applicant states that BVPS does not have any stainless steel tanks exposed to raw water as a result of leaking perimeter seals. The applicant clarifies that, instead of being designed as a partially encased tank containing a moisture barrier on the buried portions of the tanks, the RWST is located on a concrete foundation within shield walls. The applicant clarifies that it evaluated the tank bottom under exposure to an external environment of soil to make sure that the potential for pitting and crevice corrosion was addressed.

SRP-LR Section 3.2.2.2.3, Item (5) states that loss of material from pitting and crevice corrosion could occur in partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because moisture and water can egress under the tank if the perimeter seal is degraded. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR)."

For partially encased stainless steel tanks in PWR ESF systems, the GALL AMRs referred to by this SRP-LR Section are AMR item 6 in Table 2 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item V.D1-15 in Table V.D1 of the GALL Report, Revision 1, Volume 2 (GALL2).

The staff noted that LRA AMR Tables 3.2.2-1, 3.2.2-2, and 3.2.2-3, the applicant identifies the chemical addition tank (CAT) and the refueling water storage tank (RWST) as the only tanks in the ESFs that are located outside of the plant structures. The staff verified that the AMRs for these tanks are located in LRA Table 3.2.2-1 and that in these AMRs the applicant did not identify any portions of the tanks as being encased with moisture barriers and being exposed to a raw water, weathering environment (i.e., rain or snow). The staff verified from the UFSAR that these external surfaces of these tanks are not designed with external moisture barriers (i.e., perimeter seals). Based on this determination, the staff finds that the applicant has provided an acceptable basis for concluding that the AMR guidance in SRP-LR Section 3.2.2.2.3, Item (5) and the GALL AMRs that are referenced by the SRP-LR Section are not applicable to the BVPS LRA, because the staff has verified that the external surfaces of the CATs and RWSTs are not designed with external moisture barriers.

Based on the staff's review, the staff concludes that SRP-LR Section 3.2.2.2.3, Item (5) is not applicable to the BVPS LRA because the staff has verified that the CATs and RWSTs are not designed with moisture barrier seals that, otherwise if present and degraded, could induce potential loss of material in the external tank bottom surfaces.

<u>Stainless Steel Components Exposed to Internal Condensation</u>. LRA Section 3.2.2.2.3.6 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.2.2.2.3.6, "Loss of Material Due to Pitting and Crevice Corrosion, *Stainless Steel Components Exposed to Internal Condensation*," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that loss of material due to pitting and crevice corrosion is an aging effect requiring management for the stainless steel piping, piping components, and piping elements in the emergency core cooling and containment spray systems under internal exposure to condensation. The applicant states that it credits its Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Program to manage loss of material in these components as a result of exposing their internal surfaces to a condensation environment.

SRP-LR Section 3.2.2.2.3, Item (6) provides the following guidance on aging management of loss of material due to pitting and crevice corrosion in the stainless steel piping, piping components, and piping elements of emergency core cooling systems and containment spray systems that are exposed to an internal condensation environment:

> "Loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR)."

For Westinghouse designed PWRs, SRP-LR Section 3.2.2.2.3, Item (6) references AMR Item 8 in Table 2 of the GALL Report, Volume 1 (GALL1), and AMR item V.A-26 and V.D1-29 in the GALL Report, Volume 2 (GALL2), as applicable to the management of loss of material due to pitting and crevice corrosion in the internal surfaces of stainless steel piping, piping components, piping elements, and tanks in the containment spray systems and emergency core cooling systems under exposure to a condensation environment. In these AMR items, the staff recommends that a plant-specific aging management program be evaluated and credited to manage loss of material that may occur in the internal component surfaces as a result of exposure to condensation.

The staff reviewed LRA Section 3.2.2.2.3.6 on management of loss of material due to pitting and crevice corrosion in the stainless steel piping, piping components, and piping elements of the containment spray systems and emergency core cooling systems against the staff's recommended regulatory criteria in SRP-LR Section 3.2.2.2.3, Item (6); AMR Item 8 in Table 2 of the GALL Report, Volume 1; and AMR V.A-26 and V.D1-29 in the GALL Report, Volume 2.

The staff verified that the stainless steel refueling water storage tanks (RWSTs) and chemical addition tanks (CATs) are the only stainless steel piping, piping components, piping elements or tanks in containment depressurization system (i.e., contain spray system) components at BVPS whose internal surfaces could be exposed to condensation environment. The staff also noted that the applicant includes applicable AMRs for these tanks in LRA Table 3.2.2-1 that align to the recommendations in GALL AMR V.A-26, as applicable to the management of loss of material in containment spray system components under internal exposure to condensation. The staff noted that in these AMRs, the applicant credited its Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Program to manage loss of material in these components as a result of exposing the internal tank surfaces to a condensation environment.

The staff verified that the applicant also identified the internal surfaces of an unspecified stainless tank grouping in the BVPS safety injection systems as being exposed to an internal condensation environment and that the applicant includes applicable AMRs for these tanks in LRA Table 3.2.2-3 that align to the recommendations in GALL AMR V.D1-29 on management of loss of material in emergency core cooling system components under internal exposure to condensation. The staff verified that in this AMR, the applicant credited its Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Program to manage loss of material in these components as a result of exposing the internal tank surfaces to a condensation environment.

The staff verified that the applicant identifies its Internal Surfaces of Miscellaneous Piping and Ducting Program (LRA AMP B.2.28) as a new AMP that is entirely consistent with the program elements in GALL AMP XI.M38, “Inspection of Internal Surfaces of Miscellaneous Piping and Ducting,” without exception or the need for enhancement. The staff reviewed GALL AMP XI.M38, “Inspection of Internal Surfaces of Miscellaneous Piping and Ducting,” and noted that the scope of the program is designed for visual inspections of the internal surfaces of steel piping, piping elements, ducting, and components for evidence of loss of material due to corrosion in an internal environment (such as indoor uncontrolled air, condensation, and steam) that are not addressed in other aging management programs for loss of material. The staff noted that the scope of GALL AMP XI.M38 did not include the internal surfaces of stainless steel components that might be exposed to these environments.

In RAI 3.2.2.2.3.6-1, the staff asked the applicant to: (1) identify which specific tank in the safety injection system is exposed internally to the condensation environment, and (2) justify and provide its basis why the scope of the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Program is considered to be acceptable for managing the loss of material due to pitting and crevice corrosion in the stainless steel emergency safety feature (ESF) tank surfaces (including those in the RWSTs, chemical addition tanks, and the miscellaneous tank grouping in the SI system) under exposure to an internal condensation environment.

The applicant responded to RAI #3.2.2.2.3.6-1 in a letter dated July 21, 2008, In this letter, the applicant clarified that the specific tank in the safety injection systems for which "Loss of material" is compared to GALL AMR item V.D1-29, and which is linked to LRA Section 3.2.2.2.3.6 via reference from LRA AMR 3.2.1-8, is the Unit 1 Boron Injection Surge Tank. The staff finds that this response resolves the staff’s inquiry in RAI #3.2.2.2.3.6-1, Part 1 because the applicant has clarified which tank in the safety injection system the applicant was referring to. RAI #3.2.2.2.3.6-1, Part 1 is resolved.

In the response to RAI 3.2.2.2.3.6-1, Part 2, the applicant also clarified that the scope of the Internal Surfaces of Miscellaneous Piping and Ducting Program was expanded to cover the internal surfaces of miscellaneous stainless steel piping and duct components because although GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting components," program description does not currently apply to materials other than steel, similar visual inspections of stainless steel components are capable of detecting evidence of corrosion or loss of material from stainless steel surfaces prior to loss of the component intended function. The applicant also clarified that loss of material at or above the normal waterline of the internal component surface is expected to result in surface irregularities of sufficient size as to be identified visually prior to loss of component function. The staff finds that this response resolves provides an adequate basis for expanding this AMP to the internal surfaces of stainless steel components because, like steel materials (i.e., carbon steels, alloy steels, and cast iron materials), stainless steel materials are metallic components and the visual examination performed in accordance with this AMP are designed to detect discoloration that may be indicative of corrosion in the components and/or surface irregularities that may be indicative of loss of material in the components, RAI 3.2.2.2.3.6-1, Part 2 is resolved.

The staff verified that the applicant's Internal Surfaces of Miscellaneous Piping and Ducting Program is designated as a program that is consistent with the staff's program element guidance in GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," without exception or the need for enhancements, and that this AMP credits visual examinations of the internal surfaces for miscellaneous plant components to detect for evidence of loss of material or corrosion. Based on this verification, the staff finds the applicant has provided an acceptable basis for managing loss of material in the internal surfaces of the CATs, RWSTs, and Unit 1 boron injection surge tank because: (1) the staff has verified that the applicant's AMRs on loss of material for these internal tank surfaces with the staff's AMR guidance in GALL AMR V.A-26, (2) the staff has verified that the Internal Surfaces of Miscellaneous Piping and Ducting Program is a valid AMP to credit for management of loss of material in these internal tanks surfaces and is an AMP that is consistent with the staff's program element guidance in GALL AMP XI.M38, and (3) the applicant's crediting of the Internal Surfaces of Miscellaneous Piping and Ducting Program for management fulfills the recommendation in SRP-LR Section 3.2.2.2.3, Item (6) that a plant-specific AMP be evaluated to ensure that loss of material will be managed in the internal component surfaces that are exposed to a condensation environment. The staff evaluates the ability of the Internal Surfaces of Miscellaneous Piping and Ducting Program to manage loss of material and detect for corrosion in the internal surfaces for miscellaneous plant components in SER Section 3.0.3.1.12

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3, Item (6) criteria. For those line items that apply to LRA Section 3.3.2.2.3.6, 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).

3.2.2.2.4 Reduction of Heat Transfer Due to Fouling

Fouling of Heat Exchanger Tubes Exposed to Lubricating Oil. SRP-LR Section 3.2.2.2.4. Item (1) 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 existing AMP relies on monitoring and control of lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil chemistry may not always have been adequate to preclude fouling. Therefore, the effectiveness of lube oil chemistry control should be verified to ensure that fouling is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of lube oil chemistry control. 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."

In LRA Section 3.2.2.2.4.1 the applicant stated that BVPS does not have components with this material, environment, and aging effect in the ESF Systems. The applicant further stated that the charging / high-head safety injection pumps are evaluated within the Auxiliary Systems Section of the GALL Report, and were not compared to the GALL Report rows associated with this Further Evaluation section. The applicant further stated, however, that fouling of the heat exchangers in those pumps is managed by the Lubricating Oil Analysis Program with program effectiveness verified by the One-Time Inspection Program.

This further evaluation recommends that the lubricating oil chemistry control program be verified with a one-time inspection of select components at susceptible locations.

The staff confirmed that the charging and /high-head safety injection pump oil coolers are adequately addressed in the Auxiliary Systems Section because it proposes a one-time inspection in addition to the Lubricating Oil Control Program. The staff finds this acceptable because fouling of heat exchanger tubes exposed to lubricating oil is managed in accordance with the applicant's Lubricating Oil Analysis Program, with the One-Time Inspection Program being credited for verification of the effectiveness of the Lubricating Oil Analysis Program, and because this is consistent with the AMRs items on fouling in Section VII of the GALL Report, Revision 1, Volume 2 for steel, stainless steel and copper alloy heat exchanger components that are exposed to a lubricating oil environment.

Fouling of Heat Exchanger Tubes Exposed to Treated Water. 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 Section states that the existing program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may have been inadequate. Therefore, the SRP-LR Section clarifies that the GALL report recommends that the effectiveness of the chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. The SRP-LR Section clarifies that, to accomplish this, a one-time inspection is an acceptable method to ensure the reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation."

The staff noted that the AMPs proposed by the applicant in LRA Section 3.2.2.2.4.2 to manage this aging effect are the Water Chemistry Program and the One-Time Inspection Program.

The staff reviewed the Water Chemistry Program and finds that it provides for the monitoring and controlling of water chemistry using site procedures and processes for the prevention or mitigation of the reduction of heat transfer due to fouling. The staff's evaluation of the Water Chemistry Program is documented in SER Section 3.0.3.2.14. On this basis the staff finds that this program includes activities that are consistent with the recommendations in the GALL

Report and are adequate to manage reduction of heat transfer due to fouling in stainless steel heat exchanger tubes exposed to treated water during the period of extended operation.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to confirm that reduction of heat transfer due to fouling in stainless steel heat exchanger tubes exposed to treated water is managed during the period of extended operation.

3.2.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

LRA Section 3.2.2.2.5 states that hardening and loss of strength due to elastomer degradation could occur in elastomer seals and components associated with the BWR standby gas treatment system (SGTS) ductwork and filters exposed to an air-indoor uncontrolled environment. The SRP-LR sections states that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. The SRP-LR Section states that the staff's acceptance criteria for AMRs and AMPs related to this issue are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR)**.**

For the BWR components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 11 in Table 2 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item V.B-4 in Table V.B4 of the GALL Report, Revision 1, Volume 2 (GALL2).

In LRA Section 3.2.2.2.5, the applicant identified that the BVPS units are PWR-designed reactors and concludes that the guidance in SRP-LR Section 3.2.2.2.5 for these BWR components are not applicable to the BVPS LRA.

The staff verified that NUREG-1350, Volume 19 [August 2007] identifies that the BVPS units are three reactor coolant loop Westinghouse-designed PWR reactors with dry ambient containments. Thus, based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.2.2.2.5 and the referenced GALL AMRs are not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR SGTS components and because the BVPS units are Westinghouse-designed PWR reactors.

3.2.2.2.6 Loss of Material due to Erosion

SRP-LR Section 3.2.2.2.6 states that loss of material due to erosion could occur in stainless steel PWR high pressure safety injection (HPSI) pump minimum flow recirculation line orifices under exposure to a borated treated water environment. The SRP-LR sections states that the GALL Report recommends a plant-specific AMP be evaluated for erosion of the orifice as a result of extended use of the centrifugal HPSI pump during normal charging operations, and that the GALL Report references Licensee Event Report (LER) No. 50-275/94-023 with respect to operating experience on erosion events of these components. The SRP-LR Section clarifies that further evaluation of the ability of the AMP to manage this aging effect is recommended to ensure that the aging effect is adequately managed and that the staff's acceptance criteria for evaluating the AMP that is credited for aging management are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR).

For the PWR components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 12 in Table 2 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item V.D1-14 in Table V.D1 of the GALL Report, Revision 1, Volume 2 (GALL2).

In LRA Section 3.2.2.2.6, the applicant stated that the HPSI pump (charging pump) minimum flow recirculation line orifices at BVPS are evaluated within the Chemical and Volume Control System (LRA Section 2.3.3.5) and are compared to GALL1 AMR items for Auxiliary Systems. The applicant stated that it is crediting its Water Chemistry Program (LRA AMP B.2.42) to manage loss of material due to erosion for these components. The applicant clarified that the required Technical Specification (TS) surveillance requirement (SR) testing of the pumps measures the recirculation flow through the orifices and uses the flow measurements in pump TS acceptance criteria calculations, so that any degradation would be promptly identified by periodic testing.

The staff verified that the applicant included its AMR on loss of material of these flow orifices in LRA Table 3.3.2-5, "Auxiliary Systems – Chemical and Volume Control System – Summary of Aging Management Evaluation." The staff noted that in this AMR, the applicant identified that its AMR was consistent with GALL AMR item VII.E1-17 and credited its Water Chemistry Program with aging management of the aging effect.

The staff noted that the applicant was crediting of the Water Chemistry Program for aging management of loss of material in HPSI pump (charging pump) minimum flow recirculation line orifices as a result of erosion. In comparison, staff noted that GALL AMR item VII.E1-17 is applicable only to the management of loss of material in stainless steel piping, piping components and piping elements of the chemical and volume control system as a result of pitting and crevice corrosion, which are chemically-related aging mechanisms. The staff noted that the applicant's Water Chemistry Program would be a valid program to credit for managing loss of material due to pitting or crevice corrosion because the AMP uses chemical additives and stringent control of the chemical impurities that may occur in the plants coolant's to prevent the aging effects that may be induced by chemically-related aging mechanisms such as general corrosion, pitting corrosion, and crevice corrosion.

In comparison, the staff noted that erosion is a mechanical phenomenon that results in loss of material of a metallic or non-metallic component as a result of the abrasion of the component's surface against another solid surface or against the flow of a viscous liquid. As a result of this determination, the staff concluded that the Water Chemistry Program is not a valid program to credit for the management of loss of material resulting from mechanical mechanisms (such as erosion, abrasion or wear) because the chemistry-related activities of the program to control the chemical additives in the plants coolants and to minimize the chemical impurities in these coolants cannot manage aging effects that result from mechanical aging mechanisms.

SRP-LR Section A.1.1 lists performance monitoring programs are one of four acceptable aging management program categories (the other acceptable types being prevention programs, mitigation programs, and condition monitoring programs) that may be credited for management of applicable aging effects. The staff noted that the applicant was crediting its TS surveillance tests of the HPSI pumps/ CVCS charging pumps to detect loss of material due to erosion in the

HPSI minimum recirculation flow line orifices, which is TS performance monitoring program requirement for the plant. The staff noted that a performance flow monitoring program would only be capable of managing loss of material by erosion if the performance flow monitoring included measures to monitor for an increase in the flow through the minimum recirculation flow line. The staff verified that the applicant implements FENOC-imposed minimum flow line monitoring requirements (i.e., a licensee-imposed monitoring requirement) as a additional acceptance criterion requirement for determining the operability of the HPSI system, which is required under TS limiting condition of operation (LCO) Nos. 3.5.2 and 3.5.3 and that the applicant imposes these licensee-imposed requirements in accordance with an owner controlled procedure and calculation, which administratively require (a licensee-imposed requirement) to note and record for any increases or decreases in borated treated water flow outside of the normal operating flow range.

Based on this review, the staff finds that the applicant has credited an acceptable program to manage loss of material in the HPSI pump/CVCS pump minimum recirculation line orifices as a result of erosion because: (1) any HPSI system flow through the minimum recirculation flow lines that is noted to be above the normal operating flow range for the lines may be indicative of loss of material in the flow line loop piping elements (which include the orifices), (2) the applicant's performance-based minimum flow test requirements for these lines includes measures to note and record any system flow that is outside of the minimum and maximum flow range for the minimum recirculation line loops when the HPSI/CVCS system is surveillance tested, (3) if system flow through the minimum recirculation flow lines is noted to above maximum normal flow range value for the lines, the out-of-range condition will require the applicant to implement a root cause analysis to identify the source of the system flow increase and to take appropriate corrective actions under the applicant's 10 CFR Part 50, Appendix B Quality Assurance Program, and (4) this will include measures to determine whether the minimum recirculation flow lines are thinning as a result of erosion or whether some cause is increasing the flow through the system such that erosion of the lines can be ruled out. On this basis, the staff finds that the applicant has proposed an acceptable performance monitoring program to manage any potential loss of material in these orifices as a result of erosion.

3.2.2.2.7 Loss of Material Due to General Corrosion and Fouling

SRP-LR Section 3.2.2.2.7 states that loss of material due to general corrosion and fouling degradation could occur in steel BWR drywell and suppression chamber spray system nozzle and flow orifice internal surfaces under exposure to an internal air – indoor uncontrolled environment. The SRP-LR sections states that exposure of the internal steel surfaces to this environment could result in plugging of the spray nozzles and flow orifices and that this aging mechanism and effect will apply because the spray nozzles and flow orifices are occasionally wetted, and the cycling of the wet and dry conditions can result in accelerated corrosion and fouling of the internal steel surfaces. The SRP-LR Section states that, as a result of this, the GALL Report recommends further evaluation of a plant-specific AMP to ensure that the loss of material due to general corrosion and fouling is adequately managed. The SRP-LR Section states that the acceptance criteria for evaluating the AMP that is credited for this are described in Branch Technical Position RSLB-1 (Appendix A.1 of this SRP-LR).

For the BWR components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 13 in Table 2 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item V.D2-1 in Table V.D2 of the GALL Report, Revision 1, Volume 2 (GALL2).

In LRA Section 3.2.2.2.5, the applicant identified that the BVPS units are PWR-designed reactors and concludes that the guidance in SRP-LR Section 3.2.2.2.7 for these BWR components are not applicable to the BVPS LRA.

The staff verified that NUREG-1350, Volume 19 [August 2007] identifies that the BVPS units are three reactor coolant loop Westinghouse-designed PWR reactors with dry ambient containments. Thus, based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.2.2.2.7 and the referenced GALL AMRs are not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR drywell and suppression chamber spray system nozzle and flow orifice components and because the BVPS units are Westinghouse-designed PWR reactors.

3.2.2.2.8 Loss of Material Due to General, Pitting, and Crevice Corrosion

Steel Piping Components Under Exposure to Treated Water. In LRA Section 3.2.2.2.8.1, the applicant states that SRP-LR Section 3.1.2.2.8, Item (1) on management of loss of material due to general, pitting, and crevice corrosion in BWR steel piping components that are exposed to treated water is applicable to BWR plants only, inferring that the staff's guidance in this SRP-LR Section is not applicable to the scope of the BVPS LRA.

SRP-LR Section 3.2.2.2.8, Item (1) states that loss of material due to general, pitting, and crevice corrosion could occur in steel BWR piping components under exposure to a treated water environment. The SRP-LR Section states the existing AMP relies on monitoring and control of water chemistry) for BWRs to mitigate degradation, but qualifies this statement by clarifying that the control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions, and that, as a result of this fact, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The SRP-LR Section states that, for this reason, the GALL Report recommends further evaluation of a program or programs to verify the effectiveness of the water chemistry control program in managing this aging effect and 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.

For the BWR piping components referred to above, the GALL AMRs referred to by this SRP-LR Section are AMR item 14 in Table 2 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item V.D2-33 in Table V.D2 of the GALL Report, Revision 1, Volume 2 (GALL2), as applicable to the management of loss of material due to general, pitting, and crevice corrosion could occur in steel BWR piping components under exposure to a treated water environment. The aging management recommendations in these GALL AMRs are consistent with the recommended guidelines in SRP-LR Section 3.2.2.2.8, Item (1).

The staff verified that NUREG-1350, Volume 19 [August 2007] identifies that the BVPS units are three reactor coolant loop Westinghouse-designed PWR reactors with dry ambient containments. Thus, based on this review, the staff finds that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.2.2.2.8, Item (1) and the referenced GALL AMRs are not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR piping components and because the BVPS units are Westinghouse-designed PWR reactors.

Based on this review, the staff finds that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.2.2.2.8, Item (1) and the referenced GALL AMRs are not applicable to the scope of the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR piping components and because the BVPS units are Westinghouse-designed PWR reactors.

Steel Piping Components Under Exposure to Treated Water. In LRA Section 3.2.2.2.8.2, the applicant states that loss of material due to general, pitting, and crevice corrosion is possible for the internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water. In this Section of the LRA, the applicant clarified that BVPS does not have one single system that addresses containment isolation components. The applicant clarifies that instead, the internal surfaces of steel containment isolation piping and components exposed to treated water are evaluated with their parent system, and that, if loss of material due to pitting and crevice corrosion is an applicable aging effect requirement management (AERM), an appropriate aging management program is credited to manage any loss of material that may occur in the components as a result of general, pitting, or crevice corrosion.

SRP-LR Section 3.2.2.2.8, Item (2) states that loss of material due to general, pitting, and crevice corrosion could occur for the internal surfaces of steel containment isolation piping components, and piping elements exposed to treated water. The SRP-LR Section states the existing AMP relies on monitoring and control of water chemistry to mitigate degradation, but qualifies this statement by clarifying that the control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions, and that, as a result of this fact, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The SRP-LR Section states that, for this reason, the GALL Report recommends further evaluation of a program or programs to verify the effectiveness of the water chemistry control program in managing this aging effect and 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.

For the steel piping components in PWR ESFs, the GALL AMRs referred to by this SRP-LR Section are AMR item 15 in Table 2 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR item V.C-6 in Table V.C of the GALL Report, Revision 1, Volume 2 (GALL2), as applicable to the management of loss of material due to general, pitting, and crevice corrosion in steel containment isolation piping components under exposure to a treated water environment. The aging management recommendations in these GALL AMRs are consistent with the recommended guidelines in SRP-LR Section 3.2.2.2.8, Item (2).

The staff noted that SRP-LR Section 3.2.2.2.8, Item (2) and in AMR item 15 in Table 1 of the GALL1 and AMR item V.C-6 in Table V.C of GALL2 are applicable to the management loss of material in the surfaces of steel containment isolation piping, piping components, and piping elements that are exposed internally to treated water. The staff noted the LRA Table 3.2.2-1, “Containment Depressurization System – Summary of Aging Management Evaluation”; 3.2.2-2, “Residual Heat Removal System – Summary of Aging Management Evaluation”; and 3.2.2-3, “Safety Injection System – Summary of Aging Management Evaluation” do not include a piping AMR items that designated the containment depressurization systems, residual heat removal (RHR) systems, or safety injection (SI) systems include any steel containment isolation piping that is exposed internally to a treated water environment. Instead, the applicant identifies that the materials for these containment isolation piping is stainless steel. Based on this review, the staff finds that the guidance in SRP-LR Section 3.2.2.2.8 is not applicable to the applicant’s containment depressurization systems, RHR systems, or SI systems because the systems do not include any steel containment isolation piping spools that are exposed to a treated water environment.

The staff evaluates the applicant’s aging effects for the AMRs on the stainless steel piping components (including containment isolation piping) in SER Section 3.1.2.1 and in SER Section 3.2.2.2.3.3.

Steel Piping Components Exposed to Lubricating Oil. In LRA Section 3.2.2.2.8.3, the applicant states that the ESF systems at BVPS do not contain any steel piping components that are exposed to a lubricating oil environment. The applicant clarified that the high pressure safety injections (HPSI) pumps/charging pumps in the chemical and volume control (CVCS) system are evaluated in the CVCS (Section 2.3.3.5) and that the AMRs for these pumps are included in LRA Table 3.3.2-5 and are compared to the AMRs in Section VII of the GALL Report, Revision 1, Volume 2.

SRP-LR Section 3.2.2.2.8.3 states that loss of material due to general, pitting, and crevice corrosion could occur for steel ESF piping, piping components, and piping elements that are exposed to a lubricating oil environment. The SRP-LR Section states that the existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The SRP-LR Section clarifies, however, that control of lube oil contaminants may not always have been adequate to preclude corrosion, and as result of this, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The SPR-LR Section clarifies that the GALL Report therefore recommends further evaluation to verify the effectiveness of the lubricating oil program, and that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component’s intended function will be maintained during the period of extended operation.

For the steel piping components in PWR ESFs, the GALL AMRs referred to by this SRP-LR Section are AMR item 16 in Table 2 of the GALL Report, Revision 1, Volume 2 (GALL1) and AMR items V.A-25 in Table V.A the GALL Report, Revision 1, Volume 2 (GALL2) and AMR D1-28 in Table V.D1 of GALL2, as applicable to the management of loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements in contain spray systems and emergency core cooling systems under exposure to lubricating oil. The aging management recommendations in these GALL AMRs are consistent with the recommended guidelines in SRP-LR Section 3.2.2.2.8, Item (3).

The staff noted that SRP-LR Section 3.2.2.2.8.3 refers to AMR Item 16 in Table 2 of the GALL Report, Volume 1, and to AMR Items V.A-25 and V.D1-28 in Table V.A and V.D1 of the GALL Report, Volume, 2. These AMRs are applicable to steel piping, piping components, and piping elements in PWR containment spray system and emergency core cooling systems that are exposed to lubricating oil. The staff reviewed the AMR line items and verified that the LRA did not include any AMR component commodity group items that aligned to these GALL AMR items. The staff also reviewed all the other AMR line items and verified that there are not any engineered safety feature components that are exposed to lubricating oil and that should have been aligned to AMR Item 16 in Table 2 of the GALL Report, Volume 1. Therefore, since no components are or should have been aligned to AMR Item 16 in Table 2 of the GALL Report, Volume 1, and to AMR Items V.A-25 and V.D1-28 in Table V.A and V.D1 of the GALL Report, Volume, 2, the staff agrees that the SRP-LR Section 3.2.2.2.8.3 is not applicable to the BVPS LRA.

3.2.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

In LRA Section 3.2.2.2.9, the applicant states that SRP-LR Section 3.2.2.2.9 identifies that loss of material due to general, pitting, crevice, and MIC could occur for steel piping, piping components, and piping elements buried in soil regardless of the presence of pipe coating or wrapping on the external surfaces of components. The applicant clarifies that the ESF systems at BVPS do not include any steel piping components, with or without external coatings or wrappers that are exposed to a soil environment. The applicant clarifies that, therefore, this item is not applicable to the scope of the BVPS LRA.

The SRP-LR states in Paragraph 3.2.2.2.9 that loss of material due to general, pitting, crevice, and MIC could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The SRP-LR Section clarifies that, if a buried piping inspection program is credited to manage of loss of material in external surfaces of buried piping and tanks, the inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and from microbiologically-influenced corrosion (MIC). The SRP-LR Section clarifies that if this type of AMP is credited for aging management, the effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with its buried pipe components in order to ensure that loss of material is not occurring in the components.

The staff reviewed the AMRs in LRA Tables 3.2.2-1, 3.2.2-2, and 3.2.2-3 and verified that, in these AMR tables the applicant did not identify any containment spray system, RHR system or high pressure safety injection (HPSI) system steel components that are exposed to an external soil environment. Based on this review, the staff finds that the applicant has provided an acceptable basis for concluding that the recommended aging management guidance in SRP-LR Section 3.2.2.2.9 is not applicable to the scope of the BVPS LRA because the BVPS units do not include an passive-long lived ESF components that are buried and are exposed to a soil environment.

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 3.2.2-3, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.2.2-1 through 3.2.2-3, the applicant indicated, via notes F through J, which the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.2.2.3.1 Containment Depressurization System - Summary of Aging Management Evaluation – LRA Table 3.2.2-1

The staff reviewed LRA Table 3.2.2-1, which summarizes the results of AMR evaluations for the containment depressurization system component groups.

In Table 3.2.2-1, the applicant proposed to manage loss of material of stainless steel bolting, piping, pump casing, tank, and valve bodies in an external environment of condensation using the External Surfaces Monitoring Program. The staff's evaluation of the External Surfaces Monitoring Program is documented in Section 3.0.3.1.9. The LRA states that this program is consistent with GALL AMP XI.M36. However, GALL AMP XI.M36 is recommended for managing the aging effect of loss of material of carbon steel components only. The staff issued RAI B.2.15-1C to request justification for using the External Surfaces Monitoring Program to manage loss of material of stainless steel components. The RAI response is evaluated in SER Section 3.0.3.1.9 and finds the program acceptable.

In Table 3.2.2-1, the applicant proposed to manage loss of material of cast austenitic stainless steel Unit 1 RWST recirculation pump casing and valve body in an external environment of condensation using the External Surfaces Monitoring Program. The staff's evaluation of the External Surfaces Monitoring Program is documented in Section 3.0.3.1.9. The LRA states that this program is consistent with GALL AMP XI.M36. However, GALL AMP XI.M36 is recommended for managing the aging effect of loss of material of carbon steel components only. The staff issued RAI B.2.15-1(c) to request justification for using the External Surfaces Monitoring Program to manage loss of material of stainless steel components. The RAI response is evaluated in SER Section 3.0.3.1.9 and finds the program acceptable.

In LRA Table 3.2.2-1, line items 155, 156, 159, and 160, the applicant proposed to manage loss of material of steel valve bodies (Unit 2 chemical injection RV and Unit 2 RWST isolation to SIS) exposed to treated borated water for loss of material using One-Time Inspection (B.2.30) and Water Chemistry (B.2.42).

The staff reviewed the applicant's One-Time Inspection Program which is documented in SER Section 3.0.3.1.17 and the applicant's Water Chemistry Program which is documented in SER Section 3.0.3.2.13.

It is not standard practice in U.S. nuclear power plants to expose steel to borated water. Normally, the components in contact with borated water are constructed from stainless steel, nickel-alloy, or carbon steel clad with stainless steel. There are some special cases where carbon steel is in contact with borated water. The weld overlay repairs on control rod drive penetrations ended up exposing carbon steel directly to primary coolant which contains borated water. The staff reviewed this material and environment combination and concluded that there would not be unacceptable corrosion as a result of this combination because data collected in response to an RAI from the staff on the corrosion rate to be expected from the control rod drive penetration repairs show that it is not a problem. The One-Time Inspection program will verify that the corrosion rate is acceptable for the period of extended operation or that corrective action is required to insure that these valves bodies will have sufficient thickness to perform their intended function during the period of extended operation. For this reason, the staff finds these line items are acceptable.

In LRA Table 3.2.2-1, the applicant identified no aging effects for stainless steel piping, tank, and valve bodies exposed to an exterior environment of outdoor air. The staff finds that stainless steel material is susceptible to aging only if exposed to an aggressive chemical, salt water or buried environment. In a normal atmosphere environment, where rain water would tend to wash the exterior surface material rather than concentrate contaminants, the stainless steel material will have no aging effects. The applicant clarified that stress corrosion cracking (SCC) in stainless steel, which is considered plausible in wetted corrosive environments with a temperature greater than 140 ºF, will not occur in the outside air environment. On this basis, the staff finds that stainless steel in an outside air environment exhibits no aging effect, and that the component or structure will remain capable of performing its intended functions consistent with the CLB during the period of extended operation.

In LRA Table 3.2.2-1, the applicant includes its plant-specific AMR items for management of loss of material due to general, pitting and crevice corrosion in stainless steel (including cast austenitic stainless steel or CASS) components whose external surfaces are exposed to a condensation environment. The scope of these AMRs covers the following stainless steel (including CASS) components: bolting, valve bodies and pump casings (i.e., the BVPS Unit RWST recirculation pump casing). In these AMRs, the applicant credited its External Surfaces Monitoring Program to manage loss of material in the external component surfaces that are exposed to a condensation environment.

The NRC's recommended program elements in GALL AMP XI.36, "External Surfaces Monitoring" are applicable to the management of loss of material in the external surfaces of steel (i.e. carbon steel, alloy steel, or cast iron alloys) components. In the "scope of program" program element in GALL AMP XI.M36, the staff takes the following position on using the visual examinations of this program to manage loss of material in external component surfaces:

> "Visual inspections are expected to identify loss of material due to general corrosion in accessible steel components. Loss of material due to pitting and crevice corrosion may not be detectable through these same visual inspections, however, general corrosion is expected to be present and detectable such that, should pitting and crevice corrosion exist, general corrosion will manifest itself as visible rust or rust byproducts (e.g., discoloration or coating degradation) and be detectable prior to any loss of intended function. Therefore, this program is acceptable for use in inspecting for loss of material for general, pitting and crevice corrosion."

Austenitic stainless steel materials (including CASS) are typically more resistant to the aging mechanisms of general, pitting, and crevice corrosion than are steel materials because the austenitic stainless steel materials are alloyed with sufficient level of nickel and chromium that render these materials with high degree of corrosion resistance (refer to Welding Handbook, Volume 4, Seventh Edition [American Welding Society, 1982]). Thus, the staff finds that the applicant has taken a conservative position in crediting its External Surfaces Monitoring Program to manage loss of material in these austenitic stainless steel components because the stainless steel materials used in the fabrication of these components are generally more resistant to a moist environment (such as condensation) than are steel components and because the applicant will conservatively apply the periodic visual examinations of the program to monitor for general, pitting, and crevice corrosion in the external component surfaces that are exposed to a condensation environment.

In LRA Table 3.2.2-1, the applicant proposed to manage reduction of heat transfer in stainless steel heat exchanger (pump seal cooler) exposed to air-indoor uncontrolled – EXT using the External Surfaces Monitoring Program (B.2.15). During its review, the staff noted that the applicant applied Note H to this item. The staff reviewed the AMR results line that reference Note H. The External Surfaces Monitoring Program was reviewed by the staff in SER Section 3.0.3.1.9. Reduction of heat transfer is not an aging effect covered in the GALL Report for stainless steel heat exchanger (pump seal cooler) exposed to an external environment of indoor air. However, there are similar heat exchangers with stainless steel heat transfer surfaces in the GALL Report using the External Surfaces Monitoring Program to manage reduction of heat transfer. Further, the staff's evaluation of the External Surfaces Monitoring Program finds that it would be effective in identifying evidence of conditions that would contribute towards this aging effect. Therefore, the staff finds that this line item is acceptable.

In LRA Table 3.2.2-1, the applicant proposed to manage loss of material of stainless steel heat exchanger (Unit 1 RWST refrig shell) exposed to condensation – EXT using the External Surfaces Monitoring Program (B.2.15). During its review, the staff noted that the applicant applied Note H to this item. The staff reviewed the AMR results line that reference Note H. The External Surfaces Monitoring Program was reviewed by the staff in SER Section 3.0.3.1.9. Loss of material is not an aging effect covered in the GALL Report for stainless steel heat exchanger

(Unit 1 RWST refrig shell) exposed to external condensation. However, there are similar stainless steel surfaces exposed to the external condensation environment in the GALL Report. Further, the staff's evaluation of the External Surfaces Monitoring Program finds that it would be effective in managing this aging effect. Therefore, the staff finds that this line item is acceptable.

In LRA Section 3.2 and in LRA Tables 3.2.2-1, the applicant provides its plant-specific AMRs for the external surfaces of stainless steel bolting, piping, valve body, and tank components in the containment depressurization systems that are exposed to an outdoor air environment. In these AMR items, the applicants identifies that there are not any AERMs for the external piping and bolting surfaces that exposed to the outdoor air environment.

The staff noted that the stainless steel (including) components associated with these plant-specific AMR items are exposed externally to outdoor air. The staff also noted that GALL Volume 2 Table IX.D indicates that the scope of outdoor air environments include exposure to weather conditions, including wind and precipitation. The American Welding Society (AWS) "Welding Handbook," (Seventh Edition, Volume 4, 1982, Library of Congress) identifies that austenitic stainless steel materials are designed to be resistant to the phenomena of corrosion and oxidation primarily as a result of the chromium and nickel-alloying contents. Thus, based on this information, the staff finds that the applicant has provided an acceptable basis for concluding that these external stainless steel bolting and piping surfaces and CASS valve body surfaces are not subject to aging effects because any precipitation on the component surfaces only occurs on an intermittent basis (which conforms to the staff's position SRP-LR Section A.1.2.1.7 for treating the precipitation as an abnormal event) and because the stainless steel materials (including CASS) used to fabricate the components are designed to resistant to the phenomena of corrosion and oxidation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.2 Residual Heat Removal System - Summary of Aging Management Evaluation – LRA Table 3.2.2-2

The staff reviewed LRA Table 3.2.2-2, which summarizes the results of AMR evaluations for the RHR system component groups.

In LRA Table 3.2.2-2, the applicant proposed to manage reduction of heat transfer in stainless steel heat exchanger (Unit 1 and Unit 2 tube and tubesheet) exposed to treated water >60°C (>140°F) using the Water Chemistry Program (B.2.42).

During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed these AMR items for these RHR system heat exchanger components. In RAI 3.2.2.3.2-1 the staff asked the applicant to clarify the use of Note H in LRA Table 3.2.2-2 AMR lines 25 and 36 which describes that for reduction of heat transfer, the Water Chemistry Program will be used without confirmation of the One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in ensuring that the aging effect is being managed. Further, the staff asked the applicant to explain how verification of the Water Chemistry Program is accomplished to ensure that the aging effect is managed.

The applicant responded to RAI 3.2.2.3.2-1 in a letter dated October 3, 2008. In this letter, the applicant explained that Table 3.2.2-2 lines 25 and 36 address management of reduction of heat transfer for the Residual Heat Removal System heat exchangers. The applicant further explained that confirmation of the effectiveness of the Water Chemistry Program is provided by the operation of the system during plant cooldowns and that reduction of heat transfer capability would be evident during system operation.

The applicant also stated that the GALL Report Section V.D1, “Emergency Core Cooling System (Pressurized Water Reactors),” addresses the emergency core cooling systems for PWRs, including the Residual Heat Removal System however, Section V.D1 does not recommend confirmation of the Water Chemistry Program effectiveness for aging management of stainless steel components. The applicant stated that the GALL Report Sections V.D1-30 and V.D1-31 address loss of material and cracking of stainless steel in treated borated water environments. The applicant further explained that although, both V.D1-30 and V.D1-31 recommend confirmation by the One-Time Inspection Program, the GALL Report does not address “Reduction of Heat Transfer” for treated borated water environments.

The staff reviewed the applicant’s response and the AMR Lines for stainless steel in treated borated water and the GALL Report Sections V.D1-30 and V.D1-31. The staff finds the applicant’s response adequate because it explained that the component type was the Residual Heat Removal Heat Exchanger Tubes and Tubesheets and that the GALL Report does not identify the aging effect, “reduction of heat transfer” as an applicable aging effect for stainless steel exposed to borated treated water. Therefore the applicant’s use of Note H is appropriate.

The staff noted that the environment for the RHR heat exchanger components in these AMRs is borated water in which the water is treated with chemical additive for corrosion product control. The staff also noted that the applicant accomplishes this with its Water Chemistry Program. The AMR tables in Sections V and VII of the GALL Report, Volume 2 identify that loss of heat transfer function by microbiologically induced organisms is only an issue for systems that are exposed to raw water sources. Since the applicant’s Water Chemistry Program is designed to minimize corrosion products in the RHR heat exchanger components that are exposed to treated borated water, the staff finds that the applicant has adequately addressed the issue of controlling those corrosion that could potentially buildup in the system and induce a drop in the heat transfer capability of these heat exchanger components. RAI 3.2.2.3.2-1 is resolved.

In LRA Table 3.2.2-2, the applicant proposed to manage cumulative fatigue damage of stainless steel and steel bolting exposed to uncontrolled indoor air on the external surface as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.3 Safety Injection System - Summary of Aging Management Evaluation – LRA Table 3.2.2-3

The staff reviewed LRA Table 3.2.2-3, which summarizes the results of AMR evaluations for the safety injection system component groups.

In LRA Table 3.2.2-3, the applicant identified no aging effects for stainless steel piping exposed to an exterior environment of outdoor air. The staff finds that stainless steel material is susceptible to aging only if exposed to an aggressive chemical, salt water or buried environment. In a normal atmosphere environment, where rain water would tend to wash the exterior surface material rather than concentrate contaminants, the stainless steel material will have no aging effects. The applicant clarified that SCC in stainless steel, which is considered plausible in wetted corrosive environments with a temperature greater than 140 °F, will not occur in the outside air environment. On this basis, the staff finds that stainless steel in an outside air environment exhibits no aging effect, and that the component or structure will remain capable of performing its intended functions consistent with the CLB during the period of extended operation.

In LRA Table 3.2.2-3, the applicant proposed to manage reduction of heat transfer in stainless steel heat exchanger (LHSI seal cooler) using a combination of the Water Chemistry Program (B.2.42) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The Water Chemistry Program was reviewed by the staff in SER Section 3.0.3.2.14. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Reduction of heat transfer is not an aging effect covered in the GALL Report for stainless steel heat exchanger tubes or other heat transfer surfaces exposed to treated borated water. However, there are similar heat exchangers with stainless steel tubes or other heat transfer surfaces in the GALL Report using the combination of the Water Chemistry Program and One-Time Inspection Program to manage reduction of heat transfer. Further, the staff's evaluation of the Water Chemistry Program finds that it would maintain treated water quality through treatment and testing. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.2.2-3, the applicant proposed to manage reduction of heat transfer in stainless steel heat exchanger (LHSI seal cooler) exposed to air-indoor uncontrolled – EXT using the External Surfaces Monitoring Program (B.2.15). During its review, the staff noted that the applicant applied Note H to this item. The staff reviewed the AMR results line that reference Note H. The External Surfaces Monitoring Program was reviewed by the staff in SER Section 3.0.3.1.9. Reduction of heat transfer is not an aging effect covered in GALL Report for stainless steel heat exchanger (pump seal cooler) exposed to an external environment of indoor air. However, there are similar heat exchangers with stainless steel heat transfer surfaces in the GALL Report using the External Surfaces Monitoring Program to manage reduction of heat transfer.

Further, the staff's evaluation of the External Surfaces Monitoring Program finds that it would be effective in identifying evidence of conditions that would contribute towards this aging effect. Therefore, the staff finds that this line item is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the ESF components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3 Aging Management of Auxiliary Systems

This Section of the SER documents the staff's review of the applicant's AMR results for the auxiliary systems components and component groups of:

- area ventilation system - control area
- area ventilation system - plant areas
- boron recovery and primary grade water system
- building and yard drains system
- chemical and volume control system
- chilled water system
- compressed air system
- containment system
- containment vacuum and leak monitoring system
- domestic water system
- emergency diesel generators and air intake and exhaust system
- emergency diesel generators - air start system
- emergency diesel generators - crankcase vacuum system
- emergency diesel generators - fuel oil system
- emergency diesel generators - lube oil system
- emergency diesel generators - water cooling system
- emergency response facility substation system (common)
- fire protection system
- fuel pool cooling and purification system
- gaseous waste disposal system
- liquid waste disposal system
- post-accident sample system
- post-design basis accident hydrogen control system
- primary component and neutron shield tank cooling water system
- radiation monitoring system
- reactor plant sample system

- reactor plant vents and rains
- river water system (Unit 1 only)
- security diesel generator system (common)
- service water system (Unit 2 only)
- solid waste disposal system
- supplementary leak collection and release system

3.3.1 Summary of Technical Information in the Application

LRA Section 3.3 provides AMR results for the auxiliary systems components and component groups. LRA Table 3.3.1, “Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems,” is a summary comparison of the applicant’s AMRs with those evaluated in the GALL Report for the auxiliary systems components and component groups.

The applicant’s AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant’s review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of 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 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 3.3.2.1.

In the onsite audit, the staff also 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 3.3.2.2 acceptance criteria. The staff’s audit evaluations are documented in SER Section 3.3.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff’s evaluations are documented in SER Section 3.3.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.3-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.3 and addressed in the GALL Report.

Table 3.3-1 Staff Evaluation for Auxiliary System Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel cranes - structural girders exposed to air - indoor uncontrolled (external) (3.3.1-1)	Cumulative fatigue damage	TLAA to be evaluated for structural girders of cranes. See the SRP-LR, Section 4.7 for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1).	Yes	TLAA	Consistent with the GALL Report (See SER Section 3.3.2.2.1) Crane fatigue is addressed as a TLAA in Section 4.7.6.
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 the 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 (See SER Section 3.3.2.2.2)
Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution > 60°C (> 140°F) (3.3.1-4)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to PWRs (See SER Section 3.3.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel and stainless clad steel heat exchanger components exposed to treated water > 60°C (> 140°F) (3.3.1-5)	Cracking due to stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See 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 stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	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 > 60°C (> 140°F) (3.3.1-7)	Cracking due to stress corrosion cracking and cyclic loading	Water Chemistry and a plant-specific verification program. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	Yes	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See Section 3.3.2.2.4.1)
Stainless steel regenerative heat exchanger components exposed to treated borated water > 60°C (> 140°F) (3.3.1-8)	Cracking due to stress corrosion cracking and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading. A plant-specific aging management program is to be evaluated.	Yes	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See 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 stress corrosion cracking and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to stress corrosion cracking and cyclic loading. A plant-specific aging management program is to be evaluated.	Yes	Not applicable	Not Applicable to BVPS (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 stress corrosion cracking, cyclic loading	Bolting Integrity. The AMP is to be augmented by appropriate inspection to detect cracking if the bolts are not otherwise replaced during maintenance.	Yes	Not applicable	Not Applicable. High-strength bolts, where present, are not re-used following removal. (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 aging management program is to be evaluated.	Yes	External Surface Monitoring (B.2.15)	Not 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 aging management program is to be evaluated.	Yes	Not applicable	Not Applicable to BVPS (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 aging management program is to be evaluated.	Yes	Water Chemistry (B.2.42) and Boral® Surveillance Program (B.2.43)	Consistent with the 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 (B.2.24) and One-Time Inspection (B.2.30)	Consistent with the 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 reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil (3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis (B.2.24) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See SER Section 3.3.2.2.7.1)
Steel reactor coolant pump oil collection system tank exposed to lubricating oil (3.3.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection to evaluate the thickness of the lower portion of the tank	Yes	Lubricating Oil Analysis (B.2.24) and One-Time Inspection (B.2.30)	Consistent with the 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	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	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 aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	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 microbiologically influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	Yes	Buried Piping and Tanks Inspection (B.2.8)	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 microbiologically influenced corrosion, and fouling	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry (B.2.20) and One-Time Inspection (B.2.30)	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 microbiologically influenced corrosion, and fouling	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis (B.2.24) and One-Time Inspection (B.2.30)	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 BVPS (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 PWRs (See SER Section 3.3.2.2.10)
Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water (3.3.1-24)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See SER Section 3.3.2.2.10. 2)
Copper alloy HVAC piping, piping components, piping elements exposed to condensation (external) (3.3.1-25)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22), External Surface Monitoring (B.2.15) and Bolting Integrity (B.2.6)	Consistent with GALL Report (See Section 3.3.2.2.10. 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
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 (B.2.24) and One-Time Inspection (B.2.30)	Consistent with GALL Report (See Section 3.3.2.2.10.4)
Stainless steel HVAC ducting and aluminum HVAC piping, piping components and piping elements exposed to condensation (3.3.1-27)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22), External Surface Monitoring (B.2.15), Fire Protection (B.2.16) and Bolting Integrity (B.2.6)	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 aging management program is to be evaluated.	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	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 aging management program is to be evaluated.	Yes	Buried Piping and Tanks Inspection (B.2.8)	Consistent with GALL Report (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)
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	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with GALL Report (See SER Section 3.3.2.2.11)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, aluminum and copper alloy piping, piping components, and piping elements exposed to fuel oil (3.3.1-32)	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Fuel Oil Chemistry and One-Time Inspection	Yes	Fuel Oil Chemistry (B.2.20) and One-Time Inspection (B.2.30)	Consistent with GALL Report (See SER Section 3.3.2.2.12. 1)
Stainless steel piping, piping components, and piping elements exposed to lubricating oil (3.3.1-33)	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis (B.2.24) and One-Time Inspection (B.2.30)	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 aging management program is to be evaluated.	Yes	Not applicable	Not Applicable to BVPS (See SER Section 3.3.2.2.13)
Steel with stainless steel cladding pump casing exposed to treated borated water (3.3.1-35)	Loss of material due to cladding breach	A plant-specific aging management program is to be evaluated. Reference NRC IN 94-63, “Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks.”	Yes	Not applicable	Not Applicable to BVPS (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
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.3.1-37)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	BWR Reactor Water Cleanup System	No	Not applicable	Not applicable to PWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.3.1-38)	Cracking due to stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the GALL Report
Stainless steel BWR spent fuel storage racks exposed to treated water > 60°C (> 140°F) (3.3.1-39)	Cracking due to stress corrosion cracking	Water Chemistry	No	Not applicable	Not applicable to PWRs
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	Not applicable	Not Applicable to BVPS (See SER Section 3.3.2.1.1)
High-strength steel closure bolting exposed to air with steam or water leakage (3.3.1-41)	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Bolting Integrity Program (B.2.6)	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 Program (B.2.6)	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 Program (B.2.6)	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 Program (B.2.6)	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	Not applicable	Not Applicable to BVPS (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 and stainless clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water > 60°C (> 140°F) (3.3.1-46)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System (B.2.9)	Consistent with GALL Report
Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water (3.3.1-47)	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System (B.2.9)	Consistent with GALL Report
Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water (3.3.1-48)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System (B.2.9)	Consistent with GALL Report
Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water (3.3.1-49)	Loss of material due to microbiologically influenced corrosion	Closed-Cycle Cooling Water System	No	Not applicable	Not applicable to PWRs
Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.3.1-50)	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System (B.2.9)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water (3.3.1-51)	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System (B.2.9)	Consistent with GALL Report
Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water (3.3.1-52)	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Closed-Cycle Cooling Water System (B.2.9)	Consistent with GALL Report
Steel compressed air system piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-53)	Loss of material due to general and pitting corrosion	Compressed Air Monitoring	No	Fire Water System (B.2.17)	Consistent with GALL Report (See SER Section 3.3.2.1.3)
Stainless steel compressed air system piping, piping components, and piping elements exposed to internal condensation (3.3.1-54)	Loss of material due to pitting and crevice corrosion	Compressed Air Monitoring	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.3)
Steel ducting closure bolting exposed to air - indoor uncontrolled (external) (3.3.1-55)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Not applicable	BVPS addresses the aging effect for steel bolting in Item 3.3.1-43
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 Surface Monitoring (B.2.15)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping 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	Not applicable	This line item is addressed in item 3.3.1-58
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 Surface Monitoring (B.2.15), Fire Protection (B.2.16), and Fire Water System (B.2.17)	Consistent with GALL Report (See SER Section 3.3.2.1.3)
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 Surface Monitoring (B.2.15)	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 Surface Monitoring (B.2.15)	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	Fire Protection (B.2.16)	Consistent with GALL Report
Aluminum piping, piping components, and piping elements exposed to raw water (3.3.1-62)	Loss of material due to pitting and crevice corrosion	Fire Protection	No	Fire Protection (B.2.16)	Consistent with GALL Report
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 (B.2.16)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to fuel oil (3.3.1-64)	Loss of material due to general, pitting, and crevice corrosion	Fire Protection and Fuel Oil Chemistry	No	Fire Protection (B.2.16), and Fuel Oil Chemistry (B.2.20)	Consistent with GALL Report
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 BVPS (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	Fire Protection (B.2.16) and Structures Monitoring (B.2.39)	Consistent with GALL Report
Reinforced concrete structural fire barriers - walls, ceilings and floors exposed to air - outdoor or air - indoor uncontrolled (3.3.1-67)	Loss of material due to corrosion of embedded steel	Fire Protection and Structures Monitoring Program	No	Not applicable	Not Applicable to BVPS (See SER Section 3.3.2.1.1)
Steel piping, piping components, and piping elements exposed to raw water (3.3.1-68)	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling	Fire Water System	No	Fire Water System (B.2.17)	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to raw water (3.3.1-69)	Loss of material due to pitting and crevice corrosion, and fouling	Fire Water System	No	Fire Water System (B.2.17)	Consistent with GALL Report
Copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-70)	Loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling	Fire Water System	No	Fire Water System (B.2.17)	Consistent with GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to moist air or condensation (internal) (3.3.1-71)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report
Steel HVAC ducting and components internal surfaces exposed to condensation (internal) (3.3.1-72)	Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically influenced corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report)
Steel crane structural girders in load handling system exposed to air - indoor uncontrolled (external) (3.3.1-73)	Loss of material due to general corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program (B.2.23)	Consistent with GALL Report
Steel cranes - rails exposed to air - indoor uncontrolled (external) (3.3.1-74)	Loss of material due to Wear	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Not applicable	Not Applicable to BVPS (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	Not applicable	Not Applicable to BVPS (See SER Section 3.3.2.1.1)
Steel piping, piping components, and piping elements (without lining/ coating or with degraded lining/coating) exposed to raw water (3.3.1-76)	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, fouling, and lining/coating degradation	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System (B.2.32), and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with the GALL Report (See SER Section 3.3.2.1.4)

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
Steel heat exchanger components exposed to raw water (3.3.1-77)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System (B.2.32), and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with the GALL Report (See SER Section 3.3.2.1.4)
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	Open-Cycle Cooling Water System (B.2.32), and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.4)
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 System (B.2.32), and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.4)
Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-80)	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System (B.2.32)	Consistent with the GALL Report
Copper alloy piping, piping components, and piping elements, exposed to raw water (3.3.1-81)	Loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System (B.2.32), and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.4)

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
Copper alloy heat exchanger components exposed to raw water (3.3.1-82)	Loss of material due to pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System (B.2.32), and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report (See SER Section 3.3.2.1.4)
Stainless steel and copper alloy heat exchanger tubes exposed to raw water (3.3.1-83)	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System (B.2.32) and Fire Water System (B.2.17)	Consistent with GALL Report
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 of Materials (B.2.36)	Consistent with GALL Report
Gray cast iron piping, piping components, and piping elements exposed to soil, raw water, treated water, or closed-cycle cooling water (3.3.1-85)	Loss of material due to selective leaching	Selective Leaching of Materials	No	Selective Leaching of Materials (B.2.36)	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 BVPS (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 BVPS (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
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 (B.2.7)	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 (B.2.7)	Consistent with GALL Report
Stainless steel and steel with stainless steel cladding piping, piping components, piping elements, tanks, and fuel storage racks exposed to treated borated water > 60°C (> 140°F) (3.3.1-90)	Cracking due to stress corrosion cracking	Water Chemistry	No	Water Chemistry (B.2.42)	Consistent with GALL Report
Stainless steel and steel with stainless steel cladding piping, piping components, and piping elements exposed to treated borated water (3.3.1-91)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Water Chemistry (B.2.42)	Consistent with GALL Report
Galvanized steel piping, piping components, and piping elements exposed to air - indoor uncontrolled (3.3.1-92)	None	None	No	None	Consistent with the GALL Report

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, air - indoor uncontrolled (external), fuel oil, lubricating oil, raw water, treated water, and treated borated water (3.3.1-93)	None	None	No	None	Consistent with the GALL Report
Stainless steel and nickel-alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.3.1-94)	None	None	No	None	Consistent with the GALL Report
Steel and aluminum piping, piping components, and piping elements exposed to air - indoor controlled (external) (3.3.1-95)	None	None	No	None	Consistent with the GALL Report
Steel and stainless steel piping, piping components, and piping elements in concrete (3.3.1-96)	None	None	No	None	Consistent with the GALL Report
Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas (3.3.1-97)	None	None	No	None	Consistent with the GALL Report
Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to dried air (3.3.1-98)	None	None	No	None	Consistent with the GALL Report

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 < 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.3.1-99)	None	None	No	None	Consistent with the GALL Report

The staff's review of the auxiliary systems component groups followed any one of several approaches. One approach, documented in SER Section 3.3.2.1, 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 3.3.2.2, 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 3.3.2.3, 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 auxiliary systems components is documented in SER Section 3.0.3.

3.3.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.3.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the auxiliary systems components:

- Bolting Integrity Program
- Boric Acid Corrosion Program
- Buried Piping and Tanks Inspection Program
- Closed-Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- Fire Protection Program
- Fire Water System Program
- Flow-Accelerated Corrosion Program
- Fuel Oil Chemistry Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Open-Cycle Cooling Water System Program

- Selective Leaching of Materials Inspection Program
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- Water Chemistry Program

LRA Tables 3.3.2-1 through 3.3.2-32 summarizes AMRs for the auxiliary systems components and indicates AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency 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 line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

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

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

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

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the engineered safety features ESF components that are subject to an AMR. On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.3.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the subsections that follows.

3.3.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.3.1, item 40, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS AMR line items roll up to this item. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no steel tanks in diesel fuel oil system exposed outdoor air. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.3.1, items 45 and 55, the applicant states that the corresponding AMR result lines in the GALL Report is not applicable because no BVPS AMR line items roll up to these items. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to BVPS.

In LRA Table 3.3.1, item 57, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS AMR line items roll up to this item. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.3.1, items 65 and 67, the applicant states that the corresponding AMR result lines in the GALL Report is not applicable because no BVPS AMR line items roll up to these items. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to BVPS.

In LRA Table 3.3.1, item 74, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS aging evaluation of crane components considers loss of material due to wear to be an insignificant contributor to loss of material due to relatively infrequent crane use. The staff reviewed this statement, and in RAI 4.7.6-1, dated July 24, 2008, the staff asked the applicant to provide number of cranes' cycles. In its response dated July 24, 2008, the applicant provided the number of cranes' cycles accumulated to date as well as the crane cycle limit. In all cases, the actual accumulated cycles were several orders of magnitude less than that of the limits. On this basis, the staff agrees with the applicant's determination that the loss of material due to wear for steel cranes rails exposed to indoor uncontrolled air is not applicable to BVPS.

In LRA Table 3.3.1, item 75, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because BVPS does not have elastomer components subject to AMR that are exposed to raw water. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no elastomer seals and components exposed to raw water. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.3.1, items 86 and 87, the applicant states that the corresponding AMR result lines in the GALL Report is not applicable because no BVPS AMR line items roll up to these items. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no structural steel (new fuel storage rack assembly) exposed indoor uncontrolled air and that BVPS has no boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated borated water in scope. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to BVPS.

3.3.2.1.2 Cracking Due to Stress Corrosion Cracking in Stainless Steel Components Exposed to a Treated Water Greater Than 60 ºC [140 ºF]) Environment

In LRA Section 3.3 and in LRA Tables 3.3.2-5, 3.3.2-25, and 3.3.2-26, the applicant provides its component-specific AMRs for managing cracking due to stress corrosion cracking (SCC) in stainless steel or steel with internal stainless steel clad piping, piping components, piping elements, and heat exchanger components under internal exposure to a treated water (greater than 60 ºC [140 ºF]) environment. The AMR line items are applicable to the following systems and components:

- BVPS Unit 2 batch tank – jacket heat exchanger in the chemical and volume control system
- heat exchanger shells /channels in the radiation monitoring system and the reactor plant sample system
- piping components and valve bodies in the radiation monitoring system and the reactor plant sample system

In these AMR line items, the applicant identified that these AMR items are aligned to AMR 38 in Table 3 of the GALL Report, Unit 1, and to GALL AMR VII.E4-15. The applicant identifies that, for components or commodity groups specified in these AMRs, the applicant credits: (1) its Water Chemistry Program to manage cracking due to SCC in these stainless steel component surfaces under exposure to a treated water (greater than 60 ºC [140 ºF]) environment, and (2) its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing this aging effect.

In AMR item 38 in Table 3 of the GALL Report, Volume 1, and in AMR item VII.E4-15 of the GALL Report, Volume 2, the staff identifies that cracking due to SCC is an applicable aging effect requiring management for stainless steel BWR shutdown cooling system components exposed to a treated water (greater than 60 ºC [140 ºF]) environment. In these AMRs, the GALL Report recommends that the Water Chemistry Program and the BWR Stress Corrosion Cracking Program be credited to manage cracking due to SCC in the BWR shutdown cooling system component surfaces that are exposed a treated water (greater than 60 ºC [140 ºF]) environment.

The staff reviewed the information for the component specific AMRs in LRA Tables 3.3.2-5, 3.3.2-25, and 3.3.2-26 that the applicant has aligned to LRA AMR item 3.3.1-38 against the staff's recommendations in AMR item 38 in Table 3 of the GALL Report, Volume 1, and AMR item VII.E4-15 of the GALL Report, Volume 2.

The reactor units at BVPS are Westinghouse-designed PWRs. The staff verified that the recommendations in AMR item 38 in Table 3 of the GALL Report, Volume 1, and AMR item VII.E4-15 of the GALL Report, Volume 2, pertain only to the management of cracking due to SCC in BWR shutdown cooling system stainless steel piping components/elements or steel piping components/elements with internal stainless steel cladding under exposure to a treated water (greater than 60 ºC [140 ºF]) environment. The staff verified that the applicant has identified that the following stainless steel based auxiliary system components are exposed to a treated water (greater than 60 ºC [140 ºF]) environment is similar in its environmental conditions to the BWR treated water (greater than 60 ºC [140 ºF]) environment:

- BVPS Unit 2 batch tank – jacket heat exchanger in the chemical and volume control system
- heat exchanger shells /channels in the radiation monitoring system and the reactor plant sample system
- piping components and valve bodies in the radiation monitoring system and the reactor plant sample system

The staff verified that the applicant conservatively identified cracking due SCC is an applicable AERM for the components surfaces that are exposed to the treated water (greater than 60 ºC [140 ºF]) environment. The staff finds this to be an acceptable approach to aging management because the applicant has conservatively identified that the treated water (greater than 60 ºC [140 ºF]) environment at BVPS has similar environmental conditions to the treated water (greater than 60 ºC [140 ºF]) environment for BWR-designed reactors, and because, consistent with the recommendations in GALL AMR VII.E4-15, the applicant has identified that cracking due to SCC is an applicable AERM for the stainless steel components that are exposed to this environment.

The staff noted that in GALL AMR VII.E4-15, the staff recommends that the BWR Water Chemistry Program and the BWR Stress Corrosion Cracking to manage cracking due to SCC in the stainless steel BWR component surfaces that are exposed to a BWR treated water (greater than 60 ºC [140 ºF]) environment. The staff noted that the recommendations in GALL AMR

VII.E4-15 to credit the BWR Stress Corrosion Cracking Program, in part, to manage cracking due to SCC in stainless steel BWR shutdown cooling system components is applicable to BWR-designed facilities, which already have BWR Stress Corrosion Cracking Program within the scope of their CLBs. GALL AMR VII.E4-15 also recommends that the BWR Water Chemistry Program be credited to manage the aging effect of cracking due to SCC in the stainless steel BWR shutdown cooling components that are exposed to a treated water (greater than 60 ºC [140 ºF]) environment.

The staff verified that the applicant credited its PWR Water Chemistry Program, in part to manage cracking due to SCC in these stainless steel auxiliary system components as a result of exposure to a treated water (greater than 60 ºC [140 ºF]) environment. The staff finds this to be acceptable because this AMP is the AMP at BVPS that is analogous to the BWR Water Chemistry Program for BWR-designed facilities.

The staff also noted that the applicant credited its One-Time Inspection Program as the monitoring program to manage cracking due to SCC in these components. The staff also noted that this program may not have inspection methods, inspection frequencies, monitoring criteria or acceptance criteria that are analogous to those that would be credited in the BWR Stress Corrosion Cracking Program for a BWR-designed facility. In RAI 3.3.2.1.X-1, the staff requested further clarification on how the One-Time Inspection Program would be used to manage cracking due to SCC in these auxiliary system components and additional justification on why the One-Time Inspection Program is considered to be a valid AMP to manage this aging effect.

The applicant responded to RAI 3.3.2.1.X-1 in a letter dated July 21, 2008. In its response, to the first part of RAI 3.3.2.1.X-1, dated July 21, 2008, the applicant explained that the One-Time Inspection Program is sufficient to confirm that "cracking" is being adequately managed by the Water Chemistry Program. The applicant explained that it used the EPRI Mechanical Tools as the primary aging evaluation reference. Cracking due to stress corrosion cracking (SCC) is an applicable aging effect requiring management (AERM) that may occur to stainless steel components in that they are exposed to treated water environments at temperatures above 140 ºF, but only if oxygen or chlorides are present in concentrations above SCC thresholds. The applicant stated that the BVPS Water Chemistry Program manages cracking by control of these ingress and concentration of dissolved oxygen, sulfate, and halide (i.e. chlorides, fluorides, iodide, and bromide contaminants. Therefore, the Water Chemistry Program is expected to manage cracking such that the aging effect does not occur, or is occurring very slowly. The applicant stated that consistent with the GALL Report description of the AMP XI.M32, "One-Time Inspection," program, the BVPS One-Time Inspection Program will provide verification is credited to verify of the effectiveness of the Water Chemistry Program in managing cracking in these components.

The applicant stated that its methodology invoked for the GALL Report row assignment precluded comparison to a GALL Report row outside the "parent" chapter of the system if that row specified that "Further Evaluation" was required. This convention was selected to assist in the review process by assuring that reviewers of a given LRA-GALL Report Section would not need to reference Further Evaluation text in another section; however, the methodology led to less than optimum row assignments on occasion. Inclarified that in this particular case, the best fit for to the GALL Report AMR items for row these stainless steel auxiliary system are to assignments for the components in question would have been in Chapter VIII, "Steam and Power Conversion System," for cracking of stainless steel in treated water >60°C (>140 ºF) that specify the Water Chemistry and One-Time Inspection Programs (GALL Report rows AMR items VIII.B1-5, VIII.C-2, VIII.D1-5, VIII.E-30, VIII.F-24 and VIII.G-33), as applicable to the management of cracking in stainless steel piping, piping components, and piping elements in PWR main steam systems, extraction steam systems, feedwater systems, condensate systems, steam generator blowdown systems, and auxiliary feedwater systems that are exposed to treated water >60°C (>140 ºF). The applicant clarified that these GALL AMRs state that the Water Chemistry Program is an acceptable program to credit for the management of cracking in the component surfaces that are exposed to treated water >60°C (>140 ºF), and that the One-Time Inspection Program is an acceptable program to credit for the verification of the effectiveness of the Water Chemistry Program in managing this aging effect.

The applicant also stated that these rows are related to various PWR system environments similar to the Auxiliary System in question and they have identical material, environment and aging effect/mechanism combinations; they are all managed through the Water Chemistry and One Time Inspection Programs. Thus based on this determination, the applicant concluded that based on this discussion, that it is valid to credit the combination of Water Chemistry and One-Time Inspection Programs to manage cracking in these auxiliary system components to provide reasonable assurance that "cracking" is being adequately managed in lieu of a periodic condition monitoring program analogous to GALL Report, Section XI.M7, "BWR Stress Corrosion Cracking."

The staff reviewed the applicant’s response to the first part of RAI 3.3.2.1.X-1 and noted that it adequately explained how components were aligned to GALL Report line items and provided that the applicant’s basis for crediting a combination of the Water Chemistry Program and the One-Time Inspection program is used to manage cracking in stainless steel auxiliary system components for the period of extended operation. The staff noted that in GALL AMP XI.M2, “Water Chemistry,” the staff states that AMPs of this type are used primarily to mitigate damage caused by corrosion and stress corrosion cracking (SCC) and that these type of AMPs are generally effective in removing impurities from intermediate and high flow areas. The staff also noted that, in GALL AMP XI.M2, the staff also states that in certain cases as identified in the GALL Report, verification of the effectiveness of the chemistry control program is undertaken to ensure that significant degradation is not occurring and the component’s intended function will be maintained during the extended period of operation. The staff also noted that in GALL AMP XI.M32, the staff establishes position that One-Time Inspection Programs are valid programs to credit for cases where: (a) an aging effect is not expected to occur but the data is insufficient to rule it out with reasonable confidence; (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected; (c) the characteristics of the aging effect include a long incubation period, or (d) to verify the system-wide effectiveness of an AMP that is designed to prevent or minimize aging to the extent that it will not cause the loss of intended function during the period of extended operation.

The staff finds that the One-Time Inspection program provides for an inspection that would be able to detect this aging effect prior to the loss of component function. Thus, based on this review, the staff finds that the applicant has provided an acceptable basis for managing cracking in the stainless steel surfaces of the BVPS Unit 2 batch tank – jacket heat exchanger located in the chemical and volume control system, in the heat exchanger shells /channels in the radiation monitoring system and the reactor plant sample system, and in the stainless steel piping components and valve bodies in the radiation monitoring system and the reactor plant sample system that are exposed to a treated water >60°C (>140 ºF) environment because the aging management basis is consistent with the AMRs that are provided in GALL AMR items VIII.B1-5, VIII.C-2, VIII.D1-5, VIII.E-30, VIII.F-24 and VIII.G-33, and with the AMP validity statements for crediting Water Chemistry Programs and One-Time Inspection Programs in GALL AMPs XI.M2, "Water Chemistry," and XI.M32, "One-Time Inspection." RAI #3.3.2.1.X-1 is resolved.

In the second part of its response to RAI 3.3.2.1.X-1 dated July 21, 2008, the applicant stated that the One-Time Inspection Program is a new program that is consistent with the GALL Report, XI.M32 program. The following additional detail from the program element evaluation text is provided from the BVPS License Renewal Project program supporting documents:

> "Detection of Aging Effects
> The proposed program will require the use of established NDE techniques, including visual, ultrasonic, and surface techniques that are performed by qualified personnel following procedures consistent with the ASME Code and 10 CFR Part 50, Appendix B. The inspection techniques will be consistent with the GALL Report, table titled "Examples of Parameters Monitored or Inspected And Aging Effect for Specific Structure or Component." The program owner will determine the inspection techniques as appropriate.
>
> The proposed program requires representative samples of system and component populations to be selected by the Program owner. Where practical, inspections focus on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin.
>
> Acceptance Criteria
> Inspection findings (indication or relevant conditions of degradation) shall be evaluated by assigned engineering personnel and would include consideration of design standards, industry codes or standards, etc. Evaluation of inspection findings shall determine that the results are acceptable or that corrective action is required.
>
> Corrective Actions
> BVPS quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. One of the potential corrective actions to address adverse conditions is assessing the need for a periodic monitoring program."

The staff reviewed the applicant's response to the second part of RAI 3.3.2.1.X-1 and finds that it adequately explains that its One-Time Inspection program invokes an effective inspection based on GALL Report XI.M32, which would detect this aging effect prior to the period of extended operation and before loss of component function. Therefore the staff's concern in RAI 3.3.2.1.X-1 is resolved.

On the bases of its review of AMR result lines as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant has adequately addressed the aging management of cracking due to SCC in these stainless steel heat exchanger and piping components as a result of exposing the component surfaces to the treated water (greater than 60 ºC [140 ºF]) environment.

3.3.2.1.3 Loss of material due to General, Pitting and/or Crevice Corrosion in Condensation Environments or Uncontrolled Indoor Air Environments

In LRA Table 3.3.2-18, the applicant stated that loss of material of steel tank exposed to condensation environment is managed by the Fire Water System Program.

The staff noted that the applicant applied note E to this item. The applicant referenced Table 3.3-1, item 3.3.1-53 and GALL Report Volume 2, item VII.D-2. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M24, "Compressed Air Monitoring," the applicant proposed using the Fire Water System Program. Since these components are in the fire protection system, the Compressed Air Monitoring Program is not applicable and instead the Fire Water System Program is credited. The evaluation of the Fire Water System Program is documented in Section 3.0.3.2.6.

The GALL AMP XI.M24, Compressed Air Monitoring Program, recommends visual inspection to detect loss of material. On the basis that the Fire Water System Program performs periodic visual inspections or wall thickness evaluations to detect loss of material as recommended by the GALL Report, the staff finds that the use of the Fire Water System Program is acceptable to manage these aging effects.

In LRA Table 3.3.2-7, the applicant stated that loss of material of stainless steel compressed air system piping, tubing, filter housing and orifice exposed to internal condensation is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that the applicant applied note E to these items. The applicant referenced Table 3.3-1, item 3.3.1-54 and GALL Report Volume 2, item VII.D-4. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M24, "Compressed Air Monitoring," the applicant proposed using the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant also referenced Note 321, which states that this environment is associated with undried portions of the system which are expected to be potentially wetted. Furthermore, these components are in scope of license renewal under criteria 2(a), nonsafety-related SSC that may impact safety-related components.

The GALL AMP XI.M24, Compressed Air Monitoring Program, recommends visual inspection to detect loss of material and monitoring of compressed air for moisture content. The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Since the license renewal intended function for these components is leakage boundary and structural integrity to minimize impact on safety-related components, visual inspection of internal surfaces is adequate to manage aging. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspection, the staff finds the applicant's use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to be acceptable.

In LRA Table 3.4.2-9, Steam Generator Blowdown System and Table 3.4.2-10, Water Treatment System, the applicant stated that loss of material for stainless steel tank exposed to internal condensation is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that the applicant applied note E to these items. The applicant referenced Table 3.3-1, item 3.3.1-54 and GALL Report Volume 2, item VII.D-4. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M24, "Compressed Air Monitoring," the applicant proposed using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant also referenced Note 411, which states that this condensation environment represents the wetted surface of the air space in a tank, and is not associated with the Compressed Air System.

The GALL AMP XI.M24, Compressed Air Monitoring Program, recommends visual inspection to detect loss of material. The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components to which the applicant program is consistent, addresses only internal surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and amenable to the same types of visual inspections. Thus, corrosion on stainless steel internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to pitting and crevice corrosion in stainless steel tanks exposed to internal condensation. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspection, the staff finds the applicant's use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to be acceptable.

In LRA Table 3.3.2-18, "Fire Protection System – Summary of Aging Management Evaluation," the applicant stated that loss of material of steel piping, tank, hose rack and valve bodies exposed to condensation and air-indoor uncontrolled environments is managed by the Fire Protection Program.

During the audit, the staff noted that the applicant applied note E to these items.
The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M36, "External

Surface Monitoring," the applicant proposed using the Fire Protection Program. These components are in the Halon and carbon dioxide systems, which are a part of the fire protection system. The evaluation of the Fire Protection Program is documented in Section 3.0.3.2.5.

The staff noted that the Fire Protection Program has an exception that relates to the frequency of testing for Halon and carbon dioxide system. An RAI was issued to address the exception. Evaluation of the RAI is documented in Section 3.0.3.2.5.

The GALL AMP XI.M36, External Surfaces Monitoring Program, recommends visual inspection to detect loss of material. On the basis that the Fire Protection Program performs periodic visual inspections and functional testing to detect loss of material as recommended by the GALL Report, the staff finds that the use of the Fire Protection Program is acceptable to manage these aging effects.

In LRA Table 3.3.2-18, “Fire Protection System – Summary of Aging Management Evaluation,” the applicant stated that loss of material of steel valve body (hydrant) exposed to air-outdoor external environment is managed by the Fire Water System Program.

During the audit, the staff noted that the applicant applied note E to this item. The applicant referenced Table 3.3-1, item 3.3.1-58 and GALL Report Volume 2, item VII.I-9. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M36, "External Surface Monitoring," the applicant proposed using the Fire Water System Program. These components are in the fire water systems, which are a part of the fire protection system. The evaluation of the Fire Water System Program is documented in Section 3.0.3.2.6.

The GALL AMP XI.M36, External Surfaces Monitoring Program, recommends visual inspection to detect loss of material. On the basis that the Fire Water Program performs periodic visual inspections of fire hydrants to detect loss of material as recommended by the GALL Report, the staff finds that the use of the Fire Water System Program is acceptable to manage these aging effects

3.3.2.1.4 Loss of material due to General, Crevice, and/or Microbiologically Influence Corrosion, or due to Fouling or Liner/Coating Degradation In Raw Water Environments

In LRA Table 3.3.2-27, Reactor Plant Vents and Drains, and Table 3.3.2-21, Liquid Waste Disposal, the applicant stated that loss of material for nickel-alloy flexible hoses exposed to raw water is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that the applicant applied note E to these items. The applicant referenced Table 3.3-1, item 3.3.1-78 and GALL Report Volume 2, item VII.C1-13. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. These components are in systems where the environment is aerated drains from sumps and are not a part of the raw water systems where the aging effects are managed by the Open-Cycle Cooling Water System Program as part of GL 89-13, “Service Water Problems Affecting Safety-Related Equipment,” commitments.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components to which the applicant program is consistent, addresses only internal surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and amenable to the same types of visual inspections. Thus, corrosion on nickel-alloy internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to pitting and crevice corrosion in nickel-alloy flexible hoses exposed to raw water. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspection, the staff finds the applicant’s use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to be acceptable.

In LRA Table 3.3.2-3, Boron Recovery and Primary Grade Water, Table 3.3.2-27, Reactor Plant Vents and Drains, Table 3.3.2-21, Liquid Waste Disposal, Table 3.3.2-7, Compressed Air, Table 3.3.2-10, Domestic Water, and Table 3.3.2-4, Building Yard and Drains systems, the applicant stated that loss of material for steel piping, flow controllers, tank, valve body, pump casing, filter housing, heat exchanger shell heater housing and oil interceptor in a raw water environment is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that the applicant applied note E to these items. The applicant referenced Table 3.3-1, item 3.3.1-76 and GALL Report Volume 2, item VII.C1-19. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

These components are in systems where the environment is filtered water, or aerated drains from sumps, or aerated condensate drains, or condensed or separated water from portions of the system with undried air and are not a part of the raw water systems where the aging effects are managed by the Open-Cycle Cooling Water System Program as part of GL 89-13, “Service Water Problems Affecting Safety-Related Equipment,” commitments.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspection, the staff finds the applicant's use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to be acceptable.

In LRA Table 3.3.2-10, Domestic Water System, the applicant stated that loss of material for steel heat exchanger (header and shell) in a raw water environment is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that the applicant applied note E to these items. The applicant referenced Table 3.3-1, item 3.3.1-77 and GALL Report Volume 2, item VII.C1-5. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. This component is in the domestic water system and is not a part of the raw water systems where the aging effects are managed by the Open-Cycle Cooling Water System Program as part of GL 89-13 commitments.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspection, the staff finds the applicant's use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to be acceptable.

In LRA Table 3.3.2-3, Boron Recovery and Primary Grade Water, Table 3.3.2-27, Reactor Plant Vents and Drains, Table 3.3.2-21, Liquid Waste Disposal, Table 3.3.2-7, Compressed Air, Table 3.3.2-10, Domestic Water, Table 3.3.2-4, Building Yard and Drains, Table 3.3.2-22, Post-Accident Sampling, Table 3.3.2-32, Supplementary Leak Collection and Release, and Table 3.3.2-31, Solid Waste Disposal systems, the applicant stated that loss of material for stainless steel and CASS piping, tank, valve body, pump casing, filter housing, heat exchanger shell heater housing and strainer body in a raw water environment is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that the applicant applied note E to these items. The applicant referenced Table 3.3-1, item 3.3.1-79 and GALL Report Volume 2, item VII.C1-15. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

These components are in systems where the environment is filtered water, or aerated drains from sumps, or aerated condensate drains, or condensed or separated water from portions of the system with undried air and are not a part of the raw water systems where the aging effects are managed by the Open-Cycle Cooling Water System Program as part of GL 89-13 commitments.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components to which the applicant program is consistent, addresses only internal surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and amenable to the same types of visual inspections. Thus, corrosion on stainless steel and CASS internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to pitting and crevice corrosion, and fouling in stainless steel and CASS piping, tank, valve body, pump casing, filter housing, heat exchanger shell heater housing and strainer body exposed to raw water. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspection, the staff finds the applicant's use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to be acceptable.

In LRA Table 3.3.2-3, Boron Recovery and Primary Grade Water, Table 3.3.2-21, Liquid Waste Disposal, Table 3.3.2-7, Compressed Air, Table 3.3.2-10, Domestic Water, and Table 3.3.2-4, Building Yard and Drains systems, the applicant stated that loss of material for copper alloy less than and greater than 15% Zn piping, valve body, tubing, pump casing, expansion joint and strainer body in a raw water environment is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that the applicant applied note E to these items. The applicant referenced Table 3.3-1, item 3.3.1-81 and GALL Report Volume 2, item VII.C1-9. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

These components are in systems where the environment is filtered water, or aerated drains from sumps, or aerated condensate drains, or condensed or separated water from portions of the system with undried air and are not a part of the raw water systems where the aging effects are managed by the Open-Cycle Cooling Water System Program as part of GL 89-13 commitments.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components to which the applicant program is consistent, addresses only internal surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and amenable to the same types of visual inspections. Thus, corrosion on copper alloy internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material for copper alloy less than and greater than 15% Zn piping, valve body, tubing, pump casing, expansion joint and strainer body exposed to raw water. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspection, the staff finds the applicant’s use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to be acceptable.

In LRA Table 3.3.2-10, Domestic Water system, the applicant stated that loss of material for copper alloy less than 15% Zn heat exchanger tubes in a raw water environment is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that the applicant applied note E to these items. The applicant referenced Table 3.3-1, item 3.3.1-82 and GALL Report Volume 2, item VII.C1-3. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.
These components are in systems where the environment is filtered water and are not a part of the raw water systems where the aging effects are managed by the Open-Cycle Cooling Water System Program as part of GL 89-13 commitments.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components to which the applicant program is consistent, addresses only internal surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and amenable to the same types of visual inspections. Thus, corrosion on copper alloy internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material for copper alloy less than 15% Zn heat exchanger tubes exposed to raw water. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspection, the staff finds the applicant’s use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to be acceptable.

3.3.2.1.5 Loss of Material due to Selective Leaching

In LRA Table 3.3.2-4 and 3.3.2-27, the applicant proposed to manage loss of material of gray cast iron piping, pump casings, tanks, and valve bodies exposed to raw water using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During its review, the staff noted that the applicant applied Note E to these items and provided clarification by plant-specific Note 316. The staff reviewed the AMR results lines that reference Note E and determined that the component type, material, and environment, are consistent with the GALL Report which recommends the Open-Cycle Cooling Water System Program (XI.M20).

The staff reviewed plant-specific Note 316 which states that this raw water environment is associated with aerated drains from sumps and that the Open Cycle Cooling Water System Program is not applicable to this environment. The Open Cycle Cooling Water System Program was reviewed by the staff in SER Section 3.0.3.1.19. The staff noted that the applicant's proposed program would be effective in monitoring and detecting this aging effect because it would perform visual inspections of the internal surfaces of piping, pump casings, tanks, and valve bodies during the performance of maintenance activities when they are made accessible. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. On this basis, the staff finds that this aging effect will be adequately managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In the applicant's letter dated September 25, 2008, the applicant amended its LRA such that the AMP B.2.36 "Selective Leaching of Materials Inspection Program" is a plant-specific program.

The applicant noted in its amendment letter that this change affected several AMR line items. The staff evaluation of the amended AMR line items related to this AMP amendment is provided in the paragraphs that follow.

LRA Table 3.3.1, Item 3.3.1-84 and Item 3.3.1-85 addresses loss of material due to selective leaching for copper alloy with 15% zinc or more and gray cast iron components exposed to closed-cycle cooling water, raw water, treated water and soil environment. The LRA references Item 3.3.1-84 and Item 3.3.1-85 in the following systems: Area Ventilation – Control Area and Other System, Boron Recovery and Primary Grade Water System, Building and Yard Drain System, Chilled Water System, Compressed Air System, Containment Vacuum and Leakage Monitoring System, Domestic Water System, Emergency Diesel Generator and Support System, ERF Diesel Generator Support System, Fire Protection System, Liquid Waste Disposal System, Primary Component and Neutron Shield Tank Cooling System, Reactor Plant Sample System, Reactor Plant Vents and Drains System, Unit 1 River Water System, Security Diesel Generator System, Unit 2 Service Water System and Solid Waste Disposal System.

The LRA credits the AMP B.2.36 "Selective Leaching of Material Inspection Program" to manage this loss of material due to selective leaching for copper alloy with 15% zinc or more expansion joint, heat exchanger components, hose rack, piping, fittings, pump casing, strainer body, tubing and valve body components in a closed-cycle cooling water, raw water and treated water environment only. The LRA also credits the AMP B.2.36 "Selective Leaching of Material Inspection Program" to manage this loss of material due to selective leaching for gray cast iron condenser, heat exchanger components, heater housing, piping, pump casings, strainer body, valve body, tanks, and piping components in a closed-cycle cooling water, raw water, treated water and soil environment only. The GALL Report recommends GALL AMP XI.M33, "Selective Leaching of Materials" to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff verified that only piping, piping components and piping elements and heat exchanger components align to GALL Items VII.C1-4, VII.C1-10, VII.C1-11, VII.C2-6, VII.C2-7, VII.C2-8, VII.C2-9, VII.G-13, VII.G-14, VII.G-15 and VII.H2-12 and are fabricated from copper alloy 15% zinc or more and gray cast iron materials that are applicable to BVPS.

The staff reviewed the Selective Leaching of Materials Inspection Program and its evaluation is documented in SER Section 3.0.3.3.6. The staff determined that the Selective Leaching of Materials Inspection Program, which includes a visual inspection and hardness measurement to determine if selective leaching in the components with-in scope has occurred such that an evaluation of any indications of degradation will be performed to determine whether component intended function is affected and requires corrective actions in accordance with the site’s corrective action program and quality assurance procedures. The staff noted that the applicant’s proposed inspection methods, that include a visual inspection and hardness measurement, are consistent with the recommendations provided in GALL AMP XI.M33 to detect loss of material due to selective leaching. The staff further noted that the applicant will be conservatively performing periodic visual inspections and hardness measurements for buried gray cast iron fire protection piping because of operating experience of selective leaching occurring in buried gray cast iron fire protection piping.

The staff further noted that for all remaining components, a one-time visual inspection and hardness measurement will be performed and any indication of degradation will be evaluated under the corrective actions program. On the basis of periodic visual inspections and hardness measurements for gray cast iron fire protection piping and a one-time visual inspection and hardness measurement on all other components, the staff finds the applicant's use of the Selective Leaching of Materials Inspection Program acceptable.

On the basis of staff’s review of AMR items on management of components that are susceptible to loss of material by selective leaching, as described in the preceding paragraphs, and staff’s comparison of the applicant's AMRs results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AERM adequately, as recommended by the GALL Report. On this basis the staff finds the applicant has provided an acceptable basis for crediting its Selective Leaching Program for aging management of loss of material by selective leaching because the aging management basis is consistent with the staff’s basis in the GALL Report for managing selective leaching of gray cast iron components, aluminum bronze components, and components made of copper alloy containing greater than 15% zinc alloying contents.

3.3.2.1.6 Reduction of Heat Transfer in Heat Exchanger Components

In LRA Table 3.3.2-18, the applicant proposed to manage reduction of heat transfer in copper alloy >15% Zn heat exchanger (jacket water - tube) and heat exchanger (oil cooler – tube) exposed to raw water using the Fire Water System Program (B.2.17) and that the applicant aligned these components to Table 1 Item 3.3.1-83. The applicant assigned Note E to explain that although 3.3.1-83 recommends the Open-Cycle Cooling Water System Program (B.2.32), the Fire Water System Program will be substituted for these components. Further, plant-specific Note 318 explains that these components are within the fire water system and are managed by the Fire Water System Program.

The Fire Water System Program was reviewed by the staff in SER Section 3.0.3.2.6. The Open-Cycle Cooling Water System Program with which the Fire Water System Program was compared was reviewed by the staff in SER Section 3.0.3.1.19. The staff's evaluation of the Fire Water System Program finds that it would perform testing and inspection activities commensurate with the Open-Cycle Cooling Water System Program to ensure that the aging effect is managed. The testing activities include the monitoring and recording of operating temperatures and system flow rates, and other industry recognized parameters. Additionally, any evidence of reduction of heat transfer would be effectively identified by the Fire water System Program which directs that corrective actions be taken. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-18, the applicant proposed to manage reduction of heat transfer in copper alloy >15% Zn heat exchanger (oil cooler - tube) exposed to lubricating oil – EXT using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Reduction of heat transfer is not an aging effect covered in the GALL Report for copper alloy >15% Zn heat exchanger (oil cooler - tube) heat exchanger tubes or other heat transfer surfaces exposed to lubricating oil. However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing removing impurities conducive to reduction of heat transfer. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program which directs that corrective actions be taken. Therefore, the staff finds that these line items are acceptable.

SER Section 3.3.2.1 Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing 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 with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.3.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the auxiliary systems components and provides 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 microbiologically-influenced corrosion
- loss of material due to general, pitting, crevice, microbiologically-influenced corrosion 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 microbiologically-influenced corrosion
- 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 report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.3.2.2.The staff's review of the applicant's further evaluation follows.

3.3.2.2.1 Cumulative Fatigue Damage

LRA Section 3.3.2.2.1 states that management of cumulative fatigue damage in the auxiliary system (AUX) components is accomplished as a TLAA, as defined in 10 CFR 54.3. In this LRA section, the applicant states that the TLAA analysis for these components is given in LRA Section 4.3.

SRP-LR 3.3.2.2.1 identifies that management of cumulative fatigue damage is AUX components is to be accomplished as a TLAA that meets the definition of a TLAA in 10 CFR 54.3. The SRP-LR Section states that analyzed states that the applicant must evaluate its TLAA for these components in accordance with 10 CFR 54.21(c)(1). This SRP-LR Section references AMR items 1 and 2 in Table 3 of the GALL Report, Volume 1, as applicable to the management of cumulative fatigue damage in steel load bearing cranes and in AUX piping, piping components and piping elements.

The staff verified that LRA Table 3.3.1 includes AMR items 3.3.1-01 on management of cumulative fatigue damage in steel load bearing cranes. The staff verified that in this AMR, the applicant identified that it manages cumulative fatigue damage steel cranes in accordance with the TLAA that is provided in LRA Section 4.7.6. The staff also verified that the applicant provides its TLAA for these components in LRA Section 4.7.6, "Crane Load Cycles," which is the applicant TLAA Section for its steel cranes. The staff finds this to be acceptable because it is in conformance with the recommendations in SRP-LR Section 3.3.2.2.1 and in AMR item 1 in Table 3 of the GALL Report, Volume 1.The staff documents its evaluation of the applicant's TLAA for steel cranes in SER Section 4.7.6.

The staff also verified that the LRA Table 3.3.1 includes AMR item 3.3.1-02 as applicable to the management of cumulative fatigue damage in the AUX piping, piping components, and piping elements. The staff verified that in this AMR the applicant identified that it manages cumulative fatigue damage of the AUX piping, piping components, and piping elements in accordance with the TLAA that is provided in LRA Section 4.3. The staff also verified that the applicant provides its TLAA for these components in LRA Section 4.3.2, "Non-Class 1 Fatigue," which is the applicant TLAA Section for non-ASME Code Class 1 components. The staff finds this to be acceptable because it is in conformance with the recommendations in SRP-LR Section 3.3.2.2.1 and in AMR item 2 in Table 3 of the GALL Report, Volume 1.The staff documents its evaluation of the applicant's TLAA for non-Class 1 components in SER Section 4.3.2.

3.3.2.2.2 Reduction of Heat Transfer Due to Fouling

SRP-LR Section 3.3.2.2.2 states that reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water. The SRP-LR and the GALL Report incorrectly identify this item as applicable to BWR and PWR nuclear power plants. However, unique items VII.A4-4 (AP-62) and VII.E3-6 (AP-62) apply to BWR plants only. The staff finds this to be acceptable because it confirmed that both unique items are only applicable to BWR plants. This aging effect is not applicable to BVPS because it is a PWR.

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking (SCC)

BWR Standby Liquid Control System Components. In LRA Section 3.3.2.2.3.1, the applicant addresses whether the guidance in SRP-LR Section 3.3.2.2.3, Paragraph (1) is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that the guidance in SRP-LR Section 3.3.2.2.1, Paragraph (1) is applicable to management of cracking in BWR Standby Liquid Control piping components only.

SRP-LR Section identifies that cracking in BWR Standby Liquid Control piping components may occur in the internal surfaces of stainless steel piping, piping components and piping elements in BWR standby liquid control systems (SLC) that are exposed to sodium pentaborate solution greater than 60°C (>140°F). The SRP-LR Section states that the existing aging management program relies on monitoring and control of water chemistry to manage the aging effects of cracking due to SCC. However, the SRP-LR Section clarifies that high concentrations of impurities at crevices and locations of stagnant flow conditions could cause SCC, therefore, as a result of this, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that SCC is not occurring. The SRP-LR Section clarifies that a one-time inspection of select components at susceptible locations is an acceptable method to ensure that SCC is not occurring and that the component's intended function will be maintained during the period of extended operation. SRP-LR Section 3.3.2.2.3, Paragraph (1) references AMR item 4 in Table 3 of the GALL Report, Volume 1 and AMR item VII.E2-2 in the GALL Report, Volume 2. The aging management basis in these GALL AMR items is consistent with recommendations in SRP-LR Section 3.3.2.2.3, Paragraph (1).

The staff verified that NUREG-1350, Volume 19 [August 2007] identifies that the BVPS units are three reactor coolant loop Westinghouse-designed PWR reactors with dry ambient containments. Thus, based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the guidance for BWR components in SRP-LR Section 3.3.2.2.3, Paragraph (1) and the referenced GALL AMRs are not applicable to the BVPS LRA because the recommendations in these NRC guidelines are only applicable to BWR SLC components and because the BVPS units are Westinghouse-designed PWR reactors.

SCC of Heat Exchanger Components. In LRA Section 3.3.2.2.3.2, the applicant identifies that cracking due to stress corrosion cracking (SCC) may occur in the stainless steel and stainless steel clad steel heat exchanger components under exposure to a treated water greater than 60°C (140°F) environment. The applicant clarifies that, to address cracking due to SCC in the stainless steel components surfaces in the boron recovery and primary grade water systems, it credits a combination of the Water Chemistry Program and One-Time Inspection Program to manage cracking due to SCC in the stainless steel component surfaces that are exposed to a borated treated water greater than 60°C (140°F) environment. The applicant clarifies that the crediting of the Water Chemistry Program provides for monitoring and controlling of water chemistry using site procedures and processes for the prevention or mitigation of the cracking and loss of material aging effects, and that the crediting of the One-Time Inspection Program will be used to verify that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation.

SRP-LR Section 3.3.2.2.3, Paragraph (2) states that the GALL Report recommends further evaluation of programs to manage the cracking due to SCC of stainless steel and stainless steel clad heat exchanger components exposed to a treated water greater than 60°C (>140°F) environment. SRP-LR Section 3.3.2.2.3, Paragraph (2) references AMR item 5 in Table 3 of the GALL Report, Volume 1 and AMR items VII.E3-3 and VII.E3-19 in the GALL Report, Volume 2. The aging management basis in these GALL AMR items is consistent with recommendations in SRP-LR Section 3.3.2.2.3, Paragraph (2).

The staff noted that guidance in SRP-LR Section 3.3.2.2.3, Paragraph (2) is only applicable to the management of cracking in BWR reactor water cleanup system regenerative and non-regenerative heat exchangers. The staff noted that for comparable PWR components, such as the AMR for stainless steel chemical and volume control piping in GALL AMR item VII.E1-20, the staff uses only the Water Chemistry Program as its basis for managing cracking due to SCC on stainless steel chemical and volume control piping that is exposed to a borated treated water greater than 60°C (140°F) environment. In this AMR, staff does not recommend that a One-Time Inspection be coupled to the Water Chemistry Program for verification of program effectiveness because the borated compounds used in the treatment of the water are excellent corrosion inhibitors. The staff noted that, for management of cracking in the stainless steel and stainless steel clad steel heat exchanger components that are exposed treated water greater than 60°C (140°F) environment, the applicant conservatively applied the AMRs for BWR systems in GALL AMR items VII.E3-3 and VII.E3-19 as its aging management basis. The staff finds this to be an acceptable aging management basis because the treated water greater than 60°C (140°F) environment does not include borated additives that can act as a corrosion inhibitor and because the NRC's AMR guidance for the corresponding BWR components conservatively applies a One-Time Inspection Program for verification of Water Chemistry Program effectiveness. The staff concludes that the applicant has provided an acceptable basis for managing cracking due to SCC in these stainless steel heat exchanger surfaces because the applicant's aging management basis is more conservative than the NRC's recommended aging management basis in GALL AMR VII.E1-20, and because the applicant appropriately couples a One-Time Inspection to verify of the effectiveness of the Water Chemistry Program in managing cracking in the internal components surfaces that are exposed to this environment.

SCC of Stainless Steel Diesel Exhaust Piping. In Section 3.3.2.2.3.3, the applicant states that cracking due to SCC could occur in stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust. The applicant clarifies that BVPS manages cracking due to SCC of these components by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and that the program accomplishes this by crediting visual inspections of the component internal surfaces to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions.

SRP-LR Section 3.3.2.2.3, Paragraph (3) states that the GALL Report recommends further evaluation of programs to manage cracking due to SCC of stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust. SRP-LR Section 3.3.2.2.3, Paragraph (3) references AMR item 6 in Table 3 of the GALL Report, Volume 1 and AMR item VII.H2-1 in the GALL Report, Volume 2. The aging management basis in these GALL AMR items is consistent with recommendations in SRP-LR Section 3.3.2.2.3, Paragraph (3).

The staff noted that the applicant identifies its Internal Surfaces in Miscellaneous Piping and Ducting Components Program as a new BVPS program that is designed to manage aging effects that are induced by corrosion and that is consistent with the program elements in GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." The staff noted the GALL AMP XI.M38 is only applicable to the management of loss of material induced by corrosive aging mechanisms. The staff noted that GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," is not applicable to the management of cracking due to SCC. The staff also reviewed LRA AMP B.2.22 and noted, that consistent with the program elements in GALL AMP XI.M38, the "parameters monitored" program element for the applicant's AMP only credited the program to monitor for visible evidence of corrosion which may indicate possible loss of material.

The staff's issue raised in SRP-LR Section 3.2.2.2.3.3 pertains to the management of stress corrosion-induced cracking on the internal surfaces of diesel exhaust piping as a result of exposure to diesel exhaust. The staff basis for this is provided in AMR AP-33 of NUREG-1833 which cites operating experience with cracking of diesel generator exhaust piping. The staff's concern is that the diesel exhaust may be sooty and may contain contaminants and that the exhaust may coat the internal surfaces of the exhaust piping with soot or containments that, if left on the piping, may lead to the initiation of stress-corrosion induced cracking of the internal piping surfaces. The staff finds that the applicant basis to credit the Internal Surfaces in Miscellaneous Piping and Ducting Components Programs for management of this aging effect is acceptable because the visual examinations will actually be performed on the internal surfaces of the diesel generator exhaust piping to look for evidence of any cracking that has initiated in these surfaces. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12.

3.3.2.2.4 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

<u>Cracking of PWR Non-Regenerative Heat Exchanger Components</u>. SRP-LR Section 3.3.2.2.4.1 states that cracking due to SCC and cyclic loading could occur in stainless steel non-regenerative heat exchanger components exposed to treated borated water greater than 60°C (140°F) in the CVCS.

The staff noted that the AMPs proposed by the applicant in LRA Section B.2.42 and B.2.30 for managing this aging effect is the Water Chemistry Program and the One-Time Inspection Program.

The applicant stated that BVPS manages cracking of CVCS heat exchanger components with a combination of the Water Chemistry Program and the One-Time Inspection Program. The applicant explained that Water Chemistry Program provides for monitoring and controlling of water chemistry using site procedures and processes for the prevention or mitigation of the cracking and loss of material aging effects. The applicant further stated that the One-Time Inspection Program provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The applicant further explained that the One-Time Inspection Program is selected in lieu of eddy current testing of tubes and that the precedence for this is identified in NUREG-1785, Safety Evaluation Report Related to the License Renewal of H. B. Robinson Electric Plant Unit 2. Radioactivity and temperature monitoring of the shell side water is provided by installed instrumentation.

The staff reviewed the applicant’s Water Chemistry Program and the One-Time Inspection Program. Its evaluation of these programs is documented in SER Sections 3.0.3.2.14 and 3.0.3.1.17, respectively. Further, the staff reviewed NUREG-1785 and agrees that the One-Time Inspection in lieu of eddy current testing would confirm the effectiveness of the Water Chemistry Program. Therefore, the staff finds that the applicant is consistent with the GALL Report and demonstrates that the aging effects will be are adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Cracking of PWR Regenerative Heat Exchanger Components</u>. SRP-LR Section 3.3.2.2.4.2 states that cracking due to SCC and cyclic loading could occur in stainless steel regenerative heat exchanger components exposed to treated borated water greater than 60°C (140°F).

The staff noted that applicant stated in LRA Section B.2.42 and B.2.30 that BVPS manages cracking of CVCS heat exchanger components with a combination of the Water Chemistry Program and the One-Time Inspection Program. The basis for acceptability of the aging management approach is identical to that in Section 3.3.2.2.4.1

The staff reviewed the applicant’s Water Chemistry Program and the One-Time Inspection Program. Its evaluation of these programs is documented in SER Sections 3.0.3.2.14 and 3.0.3.1.17, respectively. Therefore, the staff finds that the applicant is consistent with the GALL Report and demonstrates that the aging effects will be are adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracking of PWR High-Pressure Pumps Components. LRA Section 3.3.2.2.4.3 addresses cracking due to SCC and cyclic loading that may occur in stainless steel pump casings for the PWR high-pressure pumps in the chemical and volume control system (CVCS). However, cracking of high-pressure pump casings in the CVCS is not applicable to BVPS because the pump temperature is below 60ºC (140ºF), which is the 60 °C (140 °F) temperature threshold required to support for cracking.

SRP-LR Section 3.3.2.2.4.3 states that cracking due to SCC and cyclic loading could occur for the stainless steel pump casing for the PWR high-pressure pumps in the chemical and volume control system. The SRP-LR Section states that the existing aging management program relies on monitoring and control of primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, the SRP-LR Section clarifies that the control of water chemistry does not preclude cracking due to SCC and cyclic loading and therefore recommends that, for CVCS stainless steel pump casings, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. The SRP-LR Section states that therefore the GALL Report recommends that a plant-specific aging management program be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are managed adequately. SRP-LR Section 3.3.2.2.4.2 references AMR item 9 in Table 3 of the GALL Report, Volume 1 and AMR item VII.E1-7 in Table VII.E1 of the GALL Report, Volume, The guidance in these GALL AMR items for management of cracking in the CVCS pump casings is consistent with the guidance provided in SRP-LR Section 3.3.2.2.4.3.

The staff noted that, in Table IX.D of the GALL Report, Volume 2, the staff identifies that SCC of stainless steel components under exposure to borated treated water environments is not an aging effect of concern if the operating temperature for the components is less than or equal to the threshold temperature for SCC initiation (i.e., less than or equal to a temperature of 60 ºC [≤140 ºF]). The staff noted that the applicant's basis for concluding that SCC is not an aging effect requiring management (AERM) for the stainless steel (including CASS) CVCS pump casings is consistent with the initiation statement in Table IX.D of the GALL Report, Volume 2. Based on this review, the staff finds that the applicant has provided an acceptable basis for concluding that SCC is not an AERM for the stainless steel CVCS pump casings and that the LRA does not need to include any AMR item corresponding to GALL AMR item VII.E1-7 because the applicant's basis is consistent with the staff's basis in Table IX.D of the GALL Report, Volume 2 on when SCC needs and does not need to be considered as a potential AERM for stainless steel components.

Cracking in Bolting Components. LRA Section 3.3.2.2.4.4 addresses cracking of high -strength closure bolting cracking that may occur for bolting exposed to steam or water leakage. Although there have been instances of bolt cracking in the industry, industry experience with cracking has been limited to SCC induced cracking to high-yield strength materials (>greater than 150 ksi), or induced by exposure of the bolts to contaminants such as lubricants containing molybdenum disulfide. BVPS selects proper bolting material in conjunction with the proper selection of lubricants and, through control of bolt torque, has been effective in eliminating bolting SCC. Industry data and plant-specific operating experience support this conclusion. BVPS uses high-strength bolts, which are used in a very small number of closure bolting applications, and does not re-use them after removal.

The applicant manages the cracking of high strength bolting with the Bolting Integrity Program which is discussed in Section 3.0.3.1.6. The applicant's Bolting Integrity Program follows the guidelines of EPRI NP-5769 in their selection of bolting material and the use of lubricants and sealants. Additionally, the program follows the guidelines of NUREG-1339, to prevent or mitigate degradation and failure of safety-related bolting including the verification of gasket compression, and application of an appropriate preload. The staff finds this acceptable because it is in agreement with the GALL recommendations for the Bolting Integrity Program.

3.3.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

Degradation of Elastomer Seals and Components in HVAC System. LRA Section 3.3.2.2.5.1 addresses the applicant's evaluation and basis for managing hardening and loss of strength due to elastomer degradation in heating, ventilation, and air conditioner (HVAC) systems that are exposed either internally or externally to indoor air. In this Section of the LRA, the applicant identifies that that this issue is applicable to elastomer components in the applicant's ventilation systems (e.g. flexible elastomeric collars) and credits its External Surfaces Monitoring Program to manage hardening and loss of strength in the polymeric component surfaces that are exposed either internally or externally to indoor air. The specific details of the technical information in the application are provided in LRA Section 3.3.2.2.5.1.

SRP-LR Section 3.3.2.2.5.1 states that hardening and loss of strength due to elastomer degradation may occur in elastomeric HVAC components that are exposed either internally or externally to uncontrolled indoor air. The SRP-LR recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

SRP-LR Section 3.3.2.2.5.1 invokes AMR Item 11 in Table 3 of the GALL Report, Volume 1, and AMR Items VII.F1-7, VII.F2-7, VII.F3-7 and VII.F4-6 in the GALL Report, Volume 2, as applicable to elastomeric HVAC seals in control room area ventilation systems, auxiliary and radwaste ventilation systems, primary containment heating and ventilation systems, and diesel generator ventilation systems. In these AMRs, the staff identifies that hardening and loss of strength due to elastomer degradation may occur in elastomeric HVAC components that are exposed either internally or externally to uncontrolled indoor air. In these AMRs, the staff recommends that a plant-specific aging management program is to be evaluated and credited to manage hardening and loss of strength in the elastomer seal surfaces that are exposed either internally or externally to indoor air.

The staff reviewed LRA Section 3.3.2.2.5.1 against the staff's recommended regulatory criteria in SRP-LR Section 3.3.2.2.5.1 for the specific elastomeric seals and the recommendations for these components in GALL AMR Items VII.F1-7, VII.F2-7, VII.F3-7, and VII.F4-6, as applicable to seals in the control room area ventilation systems, auxiliary and radwaste ventilation systems, primary containment heating and ventilation systems, and diesel generator ventilation systems.

The staff verified that the applicant includes the applicable AMR items in LRA Table 3.3.2-1, "Area Ventilation Systems – Plant Areas – Summary of Aging Management Evaluation," for elastomeric seals (flexible connections) in the control area ventilation system that correspond to GALL AMR Item VII.F1-7 for seals in the control room area ventilations. The staff also verified that the applicant includes applicable AMR items in LRA Table 3.3.2-2, "Area Ventilation Systems – Control Area – Summary of Aging Management Evaluation," for elastomeric seals or components in various emergency diesel generator systems (e.g., security diesel generator system, ERF diesel generator system, and emergency diesel generator and support system) and has aligned these AMRs to GALL AMR VII.F4-6. The staff also verified that the applicant includes applicable AMR items in LRA Table 3.3.2-2, “Area Ventilation Systems – Control Area – Summary of Aging Management Evaluation,” for elastomeric seals or components in the applicant’s plant ventilation systems and non-ventilation based auxiliary systems (e.g., in the chemical volume and control system, compressed air system, solid waste disposal system, and supplemental leak collection and release system) and has aligned these AMRs to GALL AMR VII.F2-7. This covers any management of hardening and loss of strength in any elastomeric seals or components in the applicant’s primary containment heating and ventilation system, because the NRC’s recommendations for management of elastomer hardening and loss of strength in GALL AMRs VII.F2-7 and VII.F3-7 are identical to one another, except for the system name.

The staff noted that the applicant credits its External Surfaces Monitoring Program to manage hardening and loss of strength in: (1) the elastomeric auxiliary system seals and components that are exposed, either internally or externally, to uncontrolled indoor air or to dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater system (i.e., a subsystem for the steam and power conversion system grouping) that are exposed externally to uncontrolled indoor air. The staff noted that the applicant has categorized this AMP as an AMP that is entirely consistent with the program elements in GALL AMP XI.M36, “External Surfaces Monitoring,” without exception or enhancement. The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, “External Surfaces Monitoring,” is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, “External Surfaces Monitoring,” does not apply to elastomeric components or to the management of hardening or loss of strength in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage hardening and loss of strength in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, “External Surfaces Monitoring,” does not include elastomeric components nor does it apply to the management of changes in material properties (such as hardening and loss of strength) that may occur in elastomeric components.

(2) The applicant’s program credits only visual examinations of the external seal surfaces as its basis for managing hardening and loss of strength in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 do not credit the visual examination as being acceptable inspection techniques for managing changes in the material properties (such as hardening or loss of strength) that may occur in elastomeric components.

In RAI 3.3.2.2.5.1-1/3.4.2.3-1A**,** the staff asked the applicant to justify using the External Surfaces Monitoring Program as the basis for managing hardening or loss of strength in: (1) the elastomeric seals or components in the applicant’s auxiliary systems under exposure, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater system (i.e., a subsystem for the steam and power conversion system grouping) that are exposed externally to uncontrolled indoor air.

The applicant responded to RAI 3.3.2.2.5.1-1/3.4.2.3-1A in a letter dated July 21, 2008. In this letter, with respect to the management of hardening or loss of strength in the elastomeric seals or components in the applicant's auxiliary systems under exposure, either internally or externally, to uncontrolled indoor air or dry air, the applicant stated that FENOC will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric components identified in LRA sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21 (a)(1)(ii). The applicant clarified that the frequency of the repetitive tasks and replacement activities will be determined based upon manufacturer recommendations and operating experience, and that therefore elastomeric seals and components in the auxiliary system (other than elastomeric flexible ventilation connection components) are classified as passive, short-lived components and can be excluded from the scope of an aging management review.

The staff verified that in the enclosure of the letter of July 21, 2008, the applicant amended the application to remove the AMRs on the elastomeric seals or components in the applicant's auxiliary systems (other than those AMRs for elastomeric flexible ventilation connections in LRA Table 3.3.2-1 and 3.3.2-2 for control area and plant area ventilation systems) and instead replace these AMRs with Commitment No. 21 UFSAR Supplement Table A.4-1 for Unit 1 and Commitment No. 23 in UFSAR Supplement Table A.5-1 for Unit 2 which calls for these non-ventilation auxiliary system seals or components to be placed in a preventative maintenance and periodic replacement program based on vendor recommendations, which constitutes a valid basis for qualified life.

The staff finds this to be an acceptable basis for addressing hardening or loss of strength in these elastomeric seals or components because placing elastomeric seals and components (other than those elastomeric flexible connections in the ventilation systems) into a periodic replacement program that is based on vendor recommendations (i.e., a qualified life eliminates the need to include these components within the scope of an ARM, which would otherwise be required by 10 CFR 54.21(a)(1)(ii) if the components were designated as passive and long-lived, and not subject to replacement on a qualified life or specified time period. RAI 3.3.2.2.5.1-1/3.4.2.3.-1A is resolved with respect to the need for aging management of these elastomeric auxiliary system components.

With respect to managing hardening and loss of strength in the elastomeric flexible connections in the control area and plant area ventilation systems, the applicant responded that the External Surface Monitoring remains as the AMP that is credited for aging management of the hardening and/or loss of strength in the components. In the letter of July 21, 2008, applicant also stated that it is amending the External Surfaces Monitoring Program to include specific program elements for these elastomeric flexible ventilation system components and to perform periodic visual inspection, coupled with physical manipulation of in-scope elastomeric components in order to detect for cracking and any indications that the, hardness or strength properties of the materials are changing. The applicant clarified that the amended program provides supplement monitoring and trending activities and qualification requirements for personnel associated with visual inspection and physical manipulation of elastomers, and that this will be accomplished in accordance with FENOC procedures and processes.

The staff finds this to be an acceptable amended basis for managing hardening and loss of strength in the elastomeric flexible ventilation connection components because the applicant is couple its visual examinations of the elastomeric components with physical manipulation activities, which will be able to determine whether the elastomeric materials are losing their elastic properties (i.e., getting hard and increasing in strength). Thus, the staff finds that the crediting of the applicant's amended Externals Surfaces Monitoring Program satisfies the recommendation in SRP-LR 3.3.2.2.5, Item (1) that a plant-specific program be evaluated to manage hardening and loss of strength in elastomeric flexible ventilation connection components. RAI 3.3.2.2.5.1-1/3.4.2.4-1A is resolved with respect to aging management of these components.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.5.1 criteria. For those line items that apply to LRA Section 3.3.2.2.5.1, the staff determines that the applicant has amended the application and has committed the LRA to place the non-ventilation elastomeric seal and components of the auxiliary systems in a preventative maintenance and periodic replacement program such that the applicant does not need to screen these components in aging management in accordance with 10 CFR 54.21(a)(1).

Degradation of Elastomer Linings of Components in Spent Fuel Pool Cooling and Cleanup Systems. LRA Section 3.3.2.2.5.2 addresses the applicant's evaluation on whether the staff's recommendation in SRP-LR Section 3.3.2.2.5.2, on management of hardening or loss of strength in elastomeric liners in design of spent fuel cooling and cleanup system filters, valves, and ion exchangers is applicable to the BVPS unit designs. In this section, the applicant states that, for PWRs, the guidance in AMR VII.A3-1 is applicable to spent fuel pool cooling and cleanup (purification) system filters, valves, and ion exchangers designed with elastomeric liners. The applicant identifies that BVPS spent fuel cooling and cleanup system designs do not include components that are designed with elastomeric liners, and that therefore, the staff's guidance in SRP-LR Section 3.3.2.2.5.2 is not applicable to the BVPS LRA.

SRP-LR Section 3.3.2.2.5.2 states that hardening and loss of strength due to elastomer degradation could occur in elastomer linings of the filters, valves, and ion exchangers in spent fuel pool cooling and cleanup systems (BWR and PWR) under exposure to either to treated water or to treated borated water. The SRP-LR recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

SRP-LR Section 3.3.2.2.5.2 invokes AMR Item 12 in Table 3 of the GALL Report, Volume 1, and AMR VII.A3-1 in the GALL Report, Volume 2, for elastomeric liners that are included the design filters, valves, and ion exchangers in PWR spent fuel pool cooling and cleanup systems. In these AMRs, the staff identifies that hardening and loss of strength due to elastomer degradation may occur in the elastomer lining under exposure to treated borated water. In these AMRs, the staff recommends that a plant-specific aging management program is to be evaluated and assessed for the qualified life of the linings under exposure to the treated borated water environment.

The staff reviewed LRA Section 3.3.2.2.5.2 against the staff's recommended regulatory criteria in SRP-LR Section 3.3.2.2.5.2; AMR Item 12 in Table 3 of the GALL Report, Volume 1; and AMR VII.A3-1 in the GALL Report, Volume 2, for elastomer linings of the filters, valves, and ion exchangers in PWR spent fuel pool cooling and cleanup systems under exposure to either to treated borated water. The staff verified that the BVPS spent fuel pool cooling and purification system components are not designed with protective elastomeric liners. Based on this review, the staff determined that the staff's guidelines in SRP-LR Section 3.3.2.2.5.2; AMR Item 12 in Table 3 of the GALL Report, Volume 1; and AMR VII.A3-1 in the GALL Report, Volume 2, are not applicable to the designs of BVPS Units 1 and 2 or to the BVPS LRA.

The staff has verified that the BVPS spent fuel pool cooling and purification system components are not designed with protective elastomeric liners. Based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding that the guidelines in SRP-LR Section 3.3.2.2.5.2; AMR Item 12 in Table 3 of the GALL Report, Volume 1; and AMR Item VII.A3-1 in the GALL Report, Volume 2, are not applicable to the BVPS LRA.

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 addresses the applicant's evaluation of the neutron absorption materials used in the fuel storage ranks in the spent fuel pools in order to assess whether potential loss of material, decomposition, or reduction of neutron-absorbing capability would need to be managed for the period of extended operation. In this section, the applicant identified that Boral® is the spent fuel pool neutron absorption material for BVPS Unit 1 and that Boraflex is the spent fuel pool neutron absorption material for BVPS Unit 2. In this Section of the LRA, the applicant also provided its basis on whether or not there are any aging effects requiring management for the Boral® materials used in the design of the BVPS Unit 1 spent fuel racks and the Boraflex materials used in the design of the BVPS Unit 2 spent fuel racks. The specific details of the technical information in the application are provided in LRA Section 3.3.2.2.6

SRP-LR Section 3.3.2.2.6 states that reduction of neutron-absorbing capacity and loss of material due to general corrosion may occur in the neutron-absorbing sheets of BWR and PWR spent fuel storage racks exposed to treated water or treated borated water. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

SRP-LR Section 3.3.2.2.6 invokes AMR Item 13 in the GALL Report, Volume 1, and AMR Item VII.A2-5 in the GALL Report, Volume 2, as applicable to PWR designs. In these AMRs, the staff identifies that reduction of neutron absorbing capacity and loss of material/ general corrosion are applicable aging effects requiring management (AERMS) for Boral® neutron absorbing materials that are used in design of PWR spent fuel pool storage racks. In these AMRs, the staff recommends that a plant-specific aging management program is to be further evaluated and credited to manage reduction of neutron absorbing capacity and loss of material/general corrosion in Boral® neutron absorbing materials that are exposed to a borated treated water environment.

SRP-LR Section 3.3.2.2.6 does not apply to the evaluation of Boraflex neutron absorption materials. The staff's recommended AMR criteria for aging management of Boraflex neutron absorption materials used in PWR spent fuel storage rack designs are given in AMR Item 87 in Table 3 of the GALL Report, Volume 1, and VII.A2-4 of the GALL Report, Volume 2

The staff reviewed LRA Section 3.3.2.2.6 against the staff's recommended regulatory criteria in SRP-LR Section 3.3.2.2.6 and in GALL AMR Item VII.A2-5 of the GALL Report, Volume 2.

The Boral® and Boraflex materials used in spent fuel pool designs do not serve a spent fuel storage rack integrity function or a spent fuel pool heat transfer function. The materials are used for the function of absorbing neutrons that result from decay of radioactive materials stored in the spent fuel pools. For the Boral® materials used in the fabrication of the BVPS Unit 1 spent fuel pool racks, the applicant stated that it reviewed the operation experience (OE) documents for Boral® degradation events and stated that the no relevant operating experience was noted citing relevant OE events with Boral® neutron absorption materials. The staff noted that the applicant's AMR that corresponds to AMR Item 13 in the GALL Report, Volume 1, is given in AMR Item 3.3-13 in LRA Table 3.3.1. In this AMR, the applicant stated that as a result of its OE review, the applicant identified that reduction of neutron absorption capability in the Boral® materials is not an aging effect requiring management for BVPS Unit 1. The applicant identified that loss of material of the Boral® materials is an aging effect requiring management (AERM) for BVPS Unit 1. The applicant credited the Water Chemistry program to manage loss of material in the Boral® coupons. The staff verified that the applicant has included the component-specific AMR on management of loss of material in the Boral® coupons in AMR Item 18 in LRA Table 3.5.2-14. In Amendment 34, dated January 19, 2009, the licensee stated that "Additionally, blistering of Boral® coupons has recently been identified at BVPS Unit 1. While the neutron absorption properties of Boral® are not affected by blistering, severe blistering could have the potential to challenge dimensional assumptions of water flux traps in the region 1 fuel storage criticality analysis. Therefore, blistering is considered an aging effect requiring management. The Boral® Surveillance Program (Section B. 2.43) will confirm the effectiveness of the Water Chemistry Program related to managing the aging effect of loss of material of the Boral's® aluminum cladding in the Unit I Spent Fuel Pool, and will manage blistering of the Boral® sheets in the Unit 1 Spent Fuel Pool."

The staff is of the opinion that if loss of material is an applicable aging effect for these Boral® materials, initiation of loss of material in the Boral® coupons could potentially lead to a reduction of the material's neutron absorption capability. In RAI 3.3.2.2.6-1**,** the staff asked the applicant to: (1) justify why reduction of neutron absorption capability was not an AERM for the Boral® materials used in the design of the BVPS Unit 1 spent fuel pool racks, and (2) provide its basis why a one-time inspection of the Boral® coupons has not been credited and coupled to the applicant's Water Chemistry Program in order to verify the effectiveness of the Water Chemistry Program in managing loss of material, and possibly reduction of neutron absorption capability, in the Boral® coupons.

In its response to RAI 3.3.2.2.6-1 dated July 21, 2008:

> The applicant stated that loss of material for Boral® is an aging effect associated with the aluminum cladding, and not with the boron carbide neutron absorber material sandwiched within the cladding. The applicant further stated that Boral® in the Unit 1 spent fuel pool rack walls is credited with maintaining sub-criticality with $k_{eff} \leq 0.95$ for stored fuel. Boral® is a neutron absorbing material of a uniformly dispersed mixture of boron carbide and aluminum powders, clad in aluminum sheets, and hot-rolled to produce an integral three-layer panel. The applicant explained that no aging effects have been identified in the industry that affect the boron carbide's neutron absorption function.

The applicant identified that the EPRI Mechanical Tools were used to determine that the aluminum cladding of Boral® may be susceptible to pitting and/or crevice corrosion in treated water. Aluminum develops a strongly-bonded oxide film, which gives it excellent corrosion resistance in many environments. This film is quite stable in neutral and many acidic solutions, but is attacked by alkalis. Aluminum alloys exhibit negligible action in boric acid solutions. The applicant confirmed that the normal environment of the Unit 1 spent fuel pool is borated water and that the Water Chemistry Program is credited with managing loss of material through the program's controls. The chemistry parameters are maintained within the normal range in which aging effects are negligible.

The applicant also explained that it credited only the Water Chemistry Program to manage loss of material of Boral® aluminum cladding because the EPRI Mechanical Tools indicate that aluminum alloys exhibit negligible corrosion in boric acid solutions. The GALL Report does not address aluminum in treated borated water, so the applicant explained that it considered stainless steel in treated borated water to be an analogous combination for the GALL Report comparison of aging management for this issue. The GALL Report, rows V.A-27 and V.D1-30, recommend management of loss of material due to pitting and crevice corrosion for some stainless steel components in treated borated water environments (including components with low or stagnant flow, such as tanks) with the Water Chemistry Program, and without verification by a One-time Inspection Program. Therefore, the applicant considered the assignment of the Water Chemistry Program without the additional assignment of a One-Time Inspection Program to have precedent in the GALL Report for management of loss of material in treated borated water.

The applicant stated that industry operating experience has not identified degradation of neutron absorption performance for Boral®, and the BVPS aging management reviews did not identify reduction of neutron absorption as an aging effect requiring management. Since reduction of neutron absorption was not identified as an aging effect requiring management, the applicant explained that it did not assign a program to manage the effect. However, the 1993 Safety Evaluation Report for BVPS Unit 1 License Amendment 178 that supported the Unit 1 fuel pool rerack (and installation of Boral®) includes a commitment for a Boral® Surveillance Program that will characterize the performance of the Boral® panels during the remaining life time of the plant. The surveillance program calls for removing and testing one coupon from the mounting jacket at the following intervals relative to the installation of the racks: 1st cycle, 2nd cycle, 4th cycle, 7th cycle, 10th cycle, 20th cycle, 30th cycle, and 40th cycle. Each coupon, upon its removal from the mounting jacket, is required to be analyzed according to the following tests:

- Visual Observation and Photography
- Neutron Attenuation
- Dimensional Measurements (length, width, and thickness)
- Weight and Specific Gravity

> The applicant described that the neutron attenuation and the dimensional measurements are used to determine whether or not the coupons are exhibiting any signs of boron loss or structural deformation, respectively. The gravimetric analyses are performed to augment the results of the neutron attenuation studies should boron loss be indicated. The BVPS operating experience from this program includes identification of coupon blistering, as well as oxidation that did not appear to be progressing. The evaluation of these results considered the potential for these effects to have an impact on the neutron absorption properties, and concluded that the results of the tests were indicative of satisfactory material performance. No changes to the current surveillance interval are planned. The next set of coupons are scheduled to be removed, inspected and tested in 2011, and are required to be compared to previous test results and other available industry OE at that time. Since the 40th cycle after installation occurs roughly 60 years after installation of the Boral®, the planned program duration exceeds the end of the period of extended operation.

The staff reviewed the applicant's response and finds that it adequately explains that through the use of the Boral® Surveillance Program, that the reduction of neutron absorption capacity aging effect, will be adequately managed for the period of extended operation. Additionally, the staff finds that the applicant's Water Chemistry Program will adequately manage the aging effect of loss of material because the program has controls to ensure that correct boron concentration in the pool. Therefore the chemistry parameters are maintained within the normal range which inhibits the corrosion of aluminum. The effectiveness of the Water Chemistry Program related to managing the aging effect of loss of material of the Boral's® aluminum cladding in the Unit 1 Spent Fuel Pool will be confirmed by the Boral® Surveillance Program (Section B.2.43).

The staff finds this to be an acceptable basis for managing reduction of neutron absorption capacity in the Boral® neutron absorption materials because the applicant has amended the application to credit a new, plant-specific Boral® Surveillance Program to manage reduction of neutron absorption capacity in the Boral® neutron absorption materials. The staff's evaluation of the ability of the Boral® Surveillance Program to manage this aging effect is given SER Section 3.0.3.3.7. The staff's evaluation includes an evaluation of the AMP's program elements against the staff' program element recommendations in SRP-LR, Appendix A.1, Section A.1.2.3. The staff's concern in RAI 3.3.2.2.6-1 is resolved.

The staff noted that the applicant conservatively used this LRA Section 3.3.2.2.6 to address whether or not aging management was required for the Boraflex coupons that are used in the design of the BVPS Unit 2 spent fuel racks, even though corresponding Section in the SRP-LR does not specifically apply to Boraflex materials. The staff noted that the LRA does not include any applicable AMR items for the Boraflex materials that are used in the BVPS Unit 2 spent fuel storage rack designs. The staff also noted that the applicant identified that the BVPS Unit 2 spent fuel pool reactivity analysis does not credit the Boraflex coupons for neutron absorbing capability or to maintaining the K_{eff} reactivity coefficient of the BVPS Unit 2 spent fuel pool within acceptable limits defined in the unit's Technical Specifications. The staff verified that the applicant's license amendment proposal requesting the change to the BVPS Unit 2 K_{eff} reactivity analysis and eliminating the need for accreditation of the Boraflex coupons for neutron absorption credit is given in the applicant's license amendment request of March 28, 2001, as amended by information submitted on September 25, 2001. The staff confirmed that the staff approved this license amendment in a safety evaluation dated February 11, 2002. Based on this review, the staff concludes that the NRC approval of the license amendment approved in the safety evaluation of February 11, 2002 provides an acceptable basis for not including appropriate AMR items in the LRA for the Boraflex materials used in the BVPS Unit 2 spent fuel pool storage rack designs.

Based on the programs identified above, the staff finds that the applicant's programs meet SRP-LR Section 3.3.2.2.6 criteria. For those line items that apply to LRA Section 3.3.2.2.6, 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). The staff concludes that, based on the staff's approval in the NRC safety evaluation of February 11, 2002, the applicant has provided an acceptable basis for concluding that the LRA does not need to include any AMR items for the Boraflex coupons that are used in the BVPS Unit 2 spent fuel storage rack design.

Based on the programs identified above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.3.2.2.6 to manage loss of material and neutron absorbing capacity of Boral® exposed to the borated treated water environment in the spent fuel pool, and that for these components, the applicant has met the criteria in SRP-LR Section 3.3.2.2.6 to manage this aging effect. For those AMR items that apply to LRA Section 3.3.2.2.6, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). Also, based on the staff's approval of the NRC safety evaluation dated February 11, 2002, concerning the Boraflex neutron absorption material in the BVPS Unit 2 spent fuel storage racks, the staff determined that the LRA is consistent with the GALL Report.

In addition, the staff concludes that, based on the staff's approval in the NRC safety evaluation of February 11, 2002, the applicant has provided an acceptable basis for concluding that the LRA does not need to include any AMR items for the Boraflex coupons that are used in the BVPS Unit 2 spent fuel storage rack design.

3.3.2.2.7 Loss of Material Due to General, Pitting, and Crevice Corrosion

<u>Reactor Coolant Pump Oil Leakage Collection System</u>. In LRA Section 3.3.2.2.7.1, the applicant states that loss of material due to general, pitting, and crevice corrosion could occur in steel components of the reactor coolant pump lube oil leakage collection system and that the impacted components may include piping, tubing, valves, and tanks. The applicant states that BVPS credits a combination of the Lubricating Oil Analysis Program (Section B.2.24) and the One-Time Inspection Program (Section B.2.30) to manage loss of material in the steel component surfaces that are exposed to lubricating oil.

SRP-LR Section 3.3.2.2.7, Paragraph (1) states that loss of material due to general, pitting, and crevice corrosion could occur in steel components of the reactor coolant pump lube oil leakage collection system exposed to lubricating oil (as part of the Fire Protection System) and identifies that the applicable components may include piping, tubing, valves, and tanks. SRP-LR

Section 3.3.2.2.7, Paragraph (1) references AMR item 16 in Table 3 of the GALL Report, Volume 1 and AMRs VII.G-27. The aging management basis in these GALL Report AMR items is consistent with recommendations in SRP-LR Section 3.3.2.2.7, Paragraph (1).

The staff noted that the AMPs proposed by the applicant in LRA Section 3.3.2.2.7.1 for managing this aging effect are the Lubricating Oil Analysis Program and the One-Time Inspection Program. The staff reviewed the Lubricating Oil Analysis Program and finds that it maintains oil systems contaminants (primarily water and particulates) within acceptable limits. This will preserve an environment that is not conducive to loss of material due to general, pitting, and crevice corrosion that could occur in steel components of the reactor coolant pump lube oil leakage collection system exposed to lubricating oil. The staff's evaluation of the Lubricating Oil Analysis Program is documented in SER Section 3.0.3.1.13. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to general, pitting, and crevice corrosion that could occur in steel components of the reactor coolant pump lube oil leakage collection system exposed to lubricating oil.
The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this program includes activities and an inspection to determine the thickness of the lower portion of the reactor coolant pump oil collection tank, that are consistent with the recommendations in the GALL Report, and are adequate to confirm that loss of material due to general, pitting, and crevice corrosion that could occur in steel components of the reactor coolant pump lube oil leakage collection system exposed to lubricating oil is managed.

Based on this review, the staff finds that the applicant has provided an acceptable basis for crediting the Lubricating Oil Analysis Program and One-Time Inspection Program to manage loss of material due to general, pitting, and crevice corrosion in the steel components of the reactor coolant pump lube oil leakage collection system under exposure to a lubricating oil environment because the applicant's aging management basis is consistent with AMPs recommended for aging management in the guidance in SRP-LR Section 3.3.2.2.7, Paragraph (1) and the GALL AMRs that are referenced by this SRP-LR section.

BWR Reactor Water Cleanup and Shutdown Cooling Systems. In LRA Section 3.3.2.2.7.2, the applicant addresses whether SRP-LR Section 3.3.2.2.7, paragraph (2) is applicable to the 'BVPS LRA. In the Section of the LRA, the applicant identifies that the applicable SRP-LR Section identifies that loss of material due to general, pitting, and crevice corrosion could occur in steel piping, piping components, and piping elements in the BWR reactor water cleanup and shutdown cooling systems exposed to treated water. The applicant clarifies that, although the applicable SRP-LR Section is applicable to BWR-designed reactors, the applicant conservatively applied the NRC guidance to those steel components systems in Westinghouse-design PWRs under exposure to treated unborated water. The applicant clarifies that this includes the carbon steel and gray cast iron components in the Auxiliary Systems that are exposed to unborated treated water.

SRP-LR Section 3.3.2.2.7, Paragraph (2) identifies that loss of material due to general, pitting, and crevice corrosion could occur in steel piping, piping components, and piping elements in the

BWR reactor water cleanup and shutdown cooling systems under exposure to treated water. The SRP-LR Section states that the existing aging management program relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from general, pitting and crevice corrosion, but qualifies this statement by clarifying that high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. Therefore, SRP-LR Section therefore recommends that the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring and states that 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. SRP-LR Section 3.3.2.2.7, Paragraph (2) references AMR item 17 in Table 3 of the GALL Report, Volume 1 and AMRs VII.E3-18 and VII.E4-17. The aging management basis in these GALL AMR items is consistent with recommendations in SRP-LR Section 3.3.2.2.7, Paragraph (2).

The staff noted that although the guidance in SRP-LR Section 3.3.2.2.7, Paragraph (2) is only applicable to the management of loss of material due to general, pitting, and crevice corrosion could occur in steel piping, piping components, and piping elements in the BWR reactor water cleanup and shutdown cooling systems (i.e. BWR auxiliary system steel components) under exposure to a treated water environment, the applicant conservatively applied the SRP-LR Section 3.3.2.2.7, Paragraph (2) to its AMRS for steel auxiliary system components at BVPS that are exposed to non-borated treated water, which is similar to the auxiliary system treated water environments at BWRs. The staff noted that consistent with the guidance in SRP-LR Section 3.3.2.2.7, Paragraph (2), the applicant is credited its Water Chemistry Program and One-Time Inspection Program to manage loss of material due to general, pitting, and crevice corrosion. Based on this review, the staff finds that the applicant's aging management basis is acceptable because it is in conformace with the aging mangement recommendations for steel components in SRP-LR Section 3.3.2.2.7, Paragraph (2) and the GALL AMRs that are reference by this SRP-LR section.

<u>Steel and Stainless Steel Diesel Exhaust Component Exposed to a Diesel Exhaust Environment</u>. In LRA Section 3.3.2.2.7.3, the applicant identifies that loss of material due to general (steel only), pitting, and crevice corrosion could occur in steel and stainless steel diesel exhaust piping, piping components, and piping elements exposed to diesel exhaust. The applicant clarifies that it credits its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material due to general, pitting, and crevice corrosion in internal component surfaces that are exposed to diesel exhaust. The applicant clarifies that the program includes visual inspections of the internal surfaces to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions and that these internal inspections are performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection.

SRP-LR Section 3.3.2.2.7, Paragraph (3) identifies that loss of material due to general (steel only) pitting and crevice corrosion could occur in BWR and PWR steel and stainless steel diesel exhaust piping, piping components, and piping elements under exposure to a diesel exhaust environment. The SRP-LR Section indicates that the GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. SRP-LR Section 3.3.2.2.7, Paragraph (3) references AMR item 18 in Table 3 of the GALL Report, Volume 1 and AMRs VII.H2-2. The aging management basis in these GALL AMR items is consistent with recommendations in SRP-LR Section 3.3.2.2.7, Paragraph (3).

The staff noted that the applicant identifies its Internal Surfaces in Miscellaneous Piping and Ducting Components Program as a new BVPS program that is designed to manage loss of material due to general, pitting, and crevice corrosion in the internal surfaces of miscellaneous piping and ducting components, and that the applicant identifies that the program elements for this AMP will be consistent with the staff's recommendations in the GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," by crediting periodic visual examinations of the internal surfaces of these component to inspect for evidence of corrosion. The staff noted that, consistent with the GALL Report AMP XI.M38, the visual inspections credited for the internal surfaces of emergency diesel generator exhaust piping components that are exposed to diesel exhaust are an example of piping in a miscellaneous, non-ASME Code safety-related component for which this program would be appropriate. The staff also noted that the applicant's inspections are scheduled to be performed during periodic surveillance tests or during maintenance activities when the internal surface becomes accessible for inspections to detect aging effects that could result in a loss of the component's intended function. The staff finds that the applicant has provided an acceptable basis for crediting this program for aging management because the emergency diesel generators (EDGs) are miscellaneous safety-related components and consistent with the GALL Report AMP XI.M38, the internal surfaces of the EDG exhaust piping are appropriate internals surfaces to include within the scope of the applicant's Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in Section 3.0.3.1.12.

3.3.2.2.8 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

In LRA Section 3.3.2.2.8, the applicant states that loss of material due to general, pitting, crevice, and MIC could occur for steel piping, piping components, and piping elements, buried in soil regardless of the presence of pipe coatings or wrappings.

The applicant states that it credits its LRA AMP B.2.8, Buried Piping and Tanks Inspection Program to manage loss of material in the external steel component surfaces of piping components exposed to soil. The applicant states that the program includes preventive measures to mitigate corrosion (e.g., coatings and wrappings required by design), and inspections to manage the effects of corrosion on the pressure-retaining capability of buried steel and stainless steel components and that preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. The applicant clarifies that the buried components will be inspected when excavated during maintenance or a planned inspection.

The SRP-LR Section 3.3.2.2.8 identifies that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion could occur for steel piping, piping components, and piping elements buried in soil. In this Section of the SRP-LR, the staff states that for applicant's crediting a Buried Piping and Tanks Inspection Program (corresponding to the GALL Report AMP XI.M34), the program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC and that the effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring. SRP-LR Section 3.3.2.2.8 references AMR item 19 in Table 3 of the GALL Report, Volume 1 and AMR items VII.C1-18, VII.C3-9, VII.G-25, and VII.H1-9 in the GALL Report, Volume 2. For applicant's crediting programs corresponding to GALL Report AMP "Buried Piping and Tanks Inspection," the aging management recommendations in these AMRs is consistent with the guidance in SRP-LR Section 3.3.2.2.8.

The GALL Report, Volume 2 identifies that AMPs corresponding to GALL Report AMP XI.M34, "Buried Piping and Tanks Inspection," are acceptable program to credits for the external surfaces of buried steel piping, piping components, and piping elements.
The staff noted that, consistent with the GALL Report, the applicant credits its Buried Piping and Tanks Inspection Program (BPTIP) to manage loss of material due to general, pitting, and crevice corrosion on external surfaces that are exposed to a soil environment. The staff noted that the applicant's "detection of aging effects" program element for this AMP credits that the visual examinations of the buried components will be performed and documented within the 10-year period prior to, and within the 10-year period after entering, the period of extended operation, and that the components will be opportunistically inspected whenever they are excavated during maintenance. The inspections will be performed in areas with the highest likelihood of corrosion, and in areas with a history of corrosion, based on plant-specific and industry operating experience. The staff finds this to be acceptable because it is in conformation with the "detection of aging effect" program element recommendation in GALL Report AMP XI.34, "Buried Piping and Tanks Inspection Program," and with the staff's recommendation that the program elements for this program be further evaluated against the GALL Report recommendations. The staff evaluates the program elements of the Buried Piping and Tanks Program to manage aging in SER Section 3.0.3.1.8.

The applicant identifies that the primary plant demineralized water storage tank is located within a concrete structure which is intended to preclude water from being in contact with the external bottom surface of the tank. The applicant stated that it is not practical to verify that air and water are not in contact with the tank bottom. The staff noted however that the applicant is treating the tank's bottom as if it may be exposed to air and water and the applicant is controlling the aging effect of loss of material using the One-Time Inspection Program. The staff finds this acceptable because this is the AMP recommended in GALL Report for tank bottoms exposed to air or water.

3.3.2.2.9 Loss of Material Due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion and Fouling

<u>Steel Components Exposed to Fuel Oil</u>. SRP-LR Section 3.3.2.2.9.1 states that loss of material due to general, pitting, crevice, MIC, and fouling may occur in steel piping, piping components, piping elements, and tanks exposed to fuel oil. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, crevice, MIC, and fouling to verify the effectiveness of the fuel oil chemistry program. Additionally, the GALL Report recommends that the verification through a one-time inspection that includes select components at susceptible locations is an acceptable method to ensure that the aging effect is not occurring.

The staff noted that the Fuel Oil Chemistry Program proposed by the applicant in LRA Section B.2.20 maintains chemistry parameters within ASTM Standards to ensure quality and to control contamination. The Fuel Oil Chemistry Program also reduces component exposure to fuel oil contamination and microbiological organisms by periodic draining and cleaning of tanks and by verifying new oil quality prior to accepting a shipment into storage tanks.

The One-Time Inspection Program provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the Fuel Oil Chemistry Program is documented in SER Section 3.0.3.2.8. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17 and includes use of visual and/or ultrasonic inspection techniques, as appropriate to confirm the effectiveness of the Fuel Oil Chemistry Program. On this basis, the staff finds that these programs include activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to general, pitting, crevice, MIC, and fouling in steel piping, piping components, piping elements, and tanks exposed to fuel oil.

<u>Steel Heat Exchanger Components Exposed to Lubricating Oil</u>. SRP-LR Section 3.3.2.2.9.2 states that loss of material due to general, pitting, crevice, MIC, and fouling could occur for steel heat exchanger components exposed to lubricating oil.

The staff noted that the AMPs proposed by the applicant in LRA Section B.2.24 and B.2.30 for managing this aging effect is the Lubricating Oil Analysis Program and the One-Time Inspection Program.

The staff reviewed the Lubricating Oil Analysis Program and finds that it maintains oil systems contaminants (primarily water and particulates) within acceptable limits, thereby preserving an environment that is not conducive to loss of material due to general, pitting, crevice, MIC, and fouling that could occur for steel heat exchanger components exposed to lubricating oil. The staff's evaluation of the Lubricating Oil Analysis Program is documented in SER Section 3.0.3.1.13. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to general, pitting, crevice, MIC, and fouling that could occur for steel heat exchanger components exposed to lubricating oil.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to confirm that loss of material due to general, pitting, crevice, MIC, and fouling that could occur for steel heat exchanger components exposed to lubricating oil is managed.

3.3.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion

<u>Steel Components With Internal Elastomer Liners or Stainless Steel Cladding Exposed Internally to Treated Water or Borated Treated Water</u>. LRA Section 3.3.2.2.10.1 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.3.2.2.10.1,

“Elastomer-Lined and Stainless Steel Clad Components Exposed to Treated or Treated Borated Water,” is applicable to the BVPS LRA.

In this Section of the LRA, the applicant states, that for PWRs, GALL AMR VII.A3-9 is the GALL AMR that is relevant to the guidance in SRP-LR Section 3.3.2.2.10.1, as applicable to steel spent fuel pool cooling and cleanup (purification) system components designed with elastomeric liners or stainless steel cladding. The applicant states that in this GALL AMR is applicable to the management of loss of material due to pitting and crevice of the steel components, only after it has been determined that degradation has occurred in the elastomeric liners or stainless steel cladding. The applicant states that the steel fuel pool cooling and purification system components at BVPS are not designed with elastomeric protective linings or stainless steel cladding, and that, therefore, the guidance in SRP-LR Section 3.3.2.2.10.1 is not applicable to the BVPS LRA.

SRP-LR Section 3.3.2.2.10.1 states that loss of material due pitting and crevice corrosion may occur in steel BWR and PWR piping that are designed with elastomeric protective linings or with stainless steel cladding under exposure to treated water or borated treated water if the elastomeric lining or stainless cladding is degraded. The SRP-LR Section states that the existing aging management program relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion, but clarifies that high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting, or crevice corrosion. Therefore, the SRP-LR Section recommends that a plant-specific program be credited to verify the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The SRP-LR Section indicates that 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.

For applicable steel PWR piping, SRP-LR Section 3.3.2.2.10.1 invokes AMR Item 22 in Table 3 of the GALL Report, Volume 1, and GALL AMR Item VII.A3-9, as applicable to the steel piping in the spent fuel pool cooling and cleanup (purification) systems designed with elastomeric linings or stainless steel cladding, where the elastomeric lining or stainless steel cladding has been determined to be degraded and the underlying steel material is exposed to treated water or borated treated water. In these AMRs, the staff recommends that the detection of crevice or pitting corrosion is to be further evaluated and that Water Chemistry Program and the One-Time Inspection be credited to manage these aging effects. This is consistent with the guidance in SRP-LR Section 3.3.2.2.10.1.

The staff reviewed LRA Section 3.3.2.2.10.1 against the staff’s recommended regulatory criteria in SRP-LR Section 3.3.2.2.10.1, and the recommendations in GALL AMRs VII.A3-9 and VII.A3-10. The staff verified that the BVPS spent fuel pool cooling and purification system piping is not steel piping designed with internal elastomeric linings or stainless steel cladding. The staff verified that, instead, the piping for the BVPS spent fuel pool cooling and purification systems is fabricated from stainless steel material. Based on this review, the staff finds that SRP-LR Section 3.3.2.2.10.1 and GALL AMRs VII.A3-9 and VII.A3-10 are not applicable to the BVPS spent fuel pool cooling and purification system designs.

The staff verified that the applicant does include AMR items #46 and #51 in the LRA Table 3.3.2-19, “Auxiliary Systems – Fuel Pool Cooling and Purification System – Summary of

Aging Management Evaluation,” to manage potential loss of material that may in the stainless steel piping of the spent fuel pool cooling and purification systems, and that these AMRs are entirely consistent with the staff’s corresponding recommendations in GALL AMR VII.A3-8 on management of loss of material in stainless steel spent fuel pool cooling and cleanup (purification) system piping that is exposed to borated treated water.
The applicant credits its Water Chemistry Program to manage loss of material that may occur in these stainless steel piping components. The staff’s evaluation of these AMRs is provided in SER Section 3.3.2.1.

The staff also verified that the staff’s guidance in SRP-LR Section 3.3.2.2.10.1; AMR Item 22 in Table 3 of the GALL Report, Volume 1, and AMR Items VIIA3-9 and VII.A3-10 in the GALL Report, Volume 2, are not applicable the design of the BVPS spent fuel pool cooling and purification system because the steel components in the system are not designed with internal elastomeric liners or stainless steel cladding. Based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding the recommended guidance in SRP-LR Section 3.3.2.2.10.1; AMR Item 22 in Table 3 of the GALL Report, Volume 1; and AMR Item VIIA3-9 and VII.A3-10 in the GALL Report, Volume 2, are not applicable to the BVPS LRA.

3.3.2.2.10.2 Stainless Steel, Steel with Stainless Cladding, and Aluminum Components Exposed to Treated Water

LRA Section 3.3.2.2.10.2 addresses the applicant’s evaluation on whether the recommended guidance in SRP-LR Section 3.3.2.2.3.1, “Loss of Material Due to Pitting and Crevice Corrosion, *Stainless Steel, Steel with Stainless Cladding, and Aluminum Components Exposed to Treated Water*,” is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that loss of material due to pitting and crevice corrosion is an applicable aging effect requiring management (AERM) for stainless steel and aluminum piping, piping components, and piping elements, and for heat exchanger components made from stainless steel or steel with internal stainless steel cladding, under exposure to a treated water environment.

The applicant clarifies that, although SRP-LR Section 3.3.2.2.10.2 is applicable to loss of material due to pitting and crevice corrosion in applicable stainless steel components in BWR spent fuel cooling and cleanup, reactor water cleanup, and shutdown cooling systems, FENOC conservatively concluded that this SRP-LR Section may be considered to be applicable to some of the unborated treated water systems containing stainless steel, aluminum, and even nickel-alloy components.

The applicant states that it credits: (1) its Water Chemistry Program to manage loss of material in these stainless steel, aluminum, and nickel-alloy component surfaces under exposure to unborated treated water, and (2) its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing this aging effect.

SRP-LR Section 3.3.2.2.10.2 provides the following guidance on management of loss of material due to pitting and crevice corrosion in stainless steel and aluminum BWR auxiliary system components that are exposed to unborated treated water:

> “Loss of material due to pitting and crevice corrosion could occur for stainless steel and aluminum piping, piping components, piping elements, and for stainless steel and steel with stainless steel cladding heat exchanger components

exposed to treated water. The existing aging management program relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting, or crevice corrosion. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the water chemistry program. 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."

SRP-LR Section 3.3.2.2.10.2 invokes AMR Item 23 in Table 3 of the GALL Report, Volume 1, and AMR item VII.A4-2 in the GALL Report Volume 2, as applicable to the management of loss of material due to pitting and crevice corrosion in the internal surfaces of BWR spent fuel cooling and cleanup system heat exchanger components made from stainless steel or steel with internal stainless steel cladding under exposure to treated water. SRP LR Section 3.3.2.2.10.2 invokes AMR Item 24 in Table 3 of the GALL Report, Volume 1, and AMR items VII.A4-5, VII.A4-11, VII.E3-7, VII.E3-15, VII.E4-4, and VII.E4-14 in the GALL Report Volume 2, as applicable to the management of loss of material due to pitting and crevice corrosion in stainless steel or aluminum piping, piping elements and piping components of BWR spent fuel cooling and purification, reactor water cleanup shutdown cooling systems made under exposure to treated water. In these AMRs, the GALL Report recommends that the Water Chemistry Program be credited to manage loss of material in the component surfaces that are exposed to treated water and that the One-Time Inspection Program be credited to verify the effectiveness of the Water Chemistry Program in managing this aging effect. This is consistent with the guidance in SRP-LR Section 3.3.2.2.10.2.

The staff reviewed the assessment in LRA Section 3.3.2.2.10.2 against the staff's recommended regulatory criteria in SRP-LR Section 3.3.2.2.10.2. The staff verified that reactor units at BVPS are Westinghouse-designed PWRs. Although, the staff verified that guidelines in SRP-LR Section 3.3.2.2.3.10.2 is applicable only to stainless steel and aluminum components in BWR systems exposed to treated unborated water, the staff determined that the applicant has conservatively aligned its AMR evaluations of loss of material in the following stainless steel (including CASS) piping, piping components, and piping elements (including valve bodies; pump casings; filter housings; flow elements/orifices; steam traps; heat exchanger tubes, tubesheets, channels, and shells; flexible hoses; strainers, sample sinks, and tubes) and tanks that are exposed to unborated treated water to SRP-LR Section 3.3.2.2.10.2, and to AMR Item 24 in Table 2 of the GALL Report, Volume 1, and AMR item VII.E3-15 in the GALL Report Volume 2:

- those in the solid waste disposal system
- those in the reactor plant sample system
- those in the radiation monitoring system
- those in the post-accident sample system
- those in the containment vacuum and leakage monitoring system
- those in the compressed air system
- those in the chemical and volume control system
- those in the boron recovery and primary grade water system

The staff also verified that, for these components, the applicant has conservatively credited its Water Chemistry Program to manage loss of material in the component surfaces that are exposed to treated water and its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing this aging effect. The staff finds this to be an acceptable approach for aging management because: (1) the stainless steel-treated water material-environmental condition combination for these components is similar to the BWR stainless steel-treated water material-environmental condition combination for BWR components that are addressed in AMR Item 24 in Table 2 of the GALL Report, Volume 1, and in AMR item VII.E3-15 in the GALL Report Volume 2, and (2) the AMPs credited for aging management are consistent with approach taken in other SRP-LR Section 3.3.2.2 subsections that provide recommendations for managing loss of material due to pitting and crevice corrosion in auxiliary system components exposed to treated water.

Based on this review, the staff finds that the applicant has provided an acceptable AMR basis in LRA Section 3.3.2.2.10.2 and in the applicant's AMRs for stainless steel auxiliary system components aligning to SRP-LR Section 3.3.2.2.10.2 and to GALL AMR VII.E3-15 to manage loss of material due to pitting and crevice corrosion in these stainless steel auxiliary system component surfaces under exposure to an unborated treated water environment.

Based on the programs identified above, the staff concludes that the applicant has conservatively applied the criteria of SRP-LR Section 3.3.2.2.10.2 to manage loss of material due to pitting and crevice corrosion in stainless steel auxiliary system components that are exposed to treated water, and that for these components, the applicant has met the criteria in SRP-LR Section 3.3.2.2.10.2 to manage this aging effect. For those AMR items that apply to LRA Section 3.1.2.2.10.2, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Copper HVAC Components Exposed Internally to Condensation. SRP-LR Section 3.3.2.2.10.3 states that loss of material due to pitting and crevice corrosion may occur in copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external). The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff noted that the plant-specific AMPs proposed by the applicant in LRA Sections B.2.22, B.2.15, and B.2.6 are the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, the External Surfaces Monitoring, and the Bolting Integrity Programs.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" to which the applicant program is consistent, addresses only internal surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and are amenable to the same types of visual inspections. Thus, corrosion on copper alloy internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting and crevice corrosion in copper alloy piping and components exposed to internal condensation.

The staff reviewed the External Surface Monitoring Program and finds that it performs periodic visual inspections of external surfaces to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the External Surface Monitoring Program is documented in SER Section 3.0.3.1.9. Although the GALL Report AMP XI.M36, “External Surface Monitoring,” to which the applicant program is consistent, addresses only external surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and amenable to the same types of visual inspections. Thus, corrosion on copper alloy internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting and crevice corrosion in copper alloy piping and components exposed to condensation.

Copper Piping Components Exposed to Lubricating Oil. SRP-LR Section 3.3.2.2.10, Paragraph 4 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.

LRA Section 3.3.2.2.10.4 states that BVPS manages piping components exposed to lubricating oil with the Lubricating Oil Analysis Program (Section B.2.24), and the One-Time Inspection Program (Section B.2.30). The Lubricating Oil Analysis Program maintains oil systems contaminants (primarily water and particulates) within acceptable limits, thereby preserving an environment that is not conducive to loss of material, cracking or reduction of heat transfer. The One-Time Inspection Program provides an inspection that either verifies that degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The Lubricating Oil Analysis Program was reviewed by the staff in Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in Section 3.0.3.1.17. Because the GALL Report lists the aging effect for copper alloy piping exposed to lubricating oil as no aging effect requiring management and no aging management program required, the staff finds that the use of the Lubricating Oil Analysis Program (Section B.2.24), and the One-Time Inspection Program (Section B.2.30) are acceptable because they exceed the GALL Report recommendation.

Aluminum and Stainless HVAC Components Exposed Internally to Condensation. SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff noted that the plant-specific AMPs proposed by the applicant in LRA Sections B.2.22, B.2.15, B.2.6, and B.2.16 are the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Component Program, the External Surfaces Monitoring Program, the Bolting Integrity Program, and the Fire Protection Program.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL Report AMP XI.M38," Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" to which the applicant program is consistent, addresses only internal surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and are amenable to the same types of visual inspections. Thus, corrosion on aluminum and stainless steel internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting and crevice corrosion in HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to internal condensation.

The staff reviewed the External Surface Monitoring Program and finds that it performs periodic visual inspections of external surfaces to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the External Surface Monitoring Program is documented in SER Section 3.0.3.1.9. Although the GALL Report AMP XI.M36, "External Surface Monitoring," to which the applicant program is consistent, addresses only external surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and are amenable to the same types of visual inspections. Thus, corrosion on aluminum and stainless steel external surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting and crevice corrosion in HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation.

The staff reviewed the Fire Protection Program and finds that it performs periodic performance tests and visual inspection of Halon and carbon dioxide system components to detect age related degradation. The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3.2.5. On this basis the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to pitting and crevice corrosion in HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation.

<u>Copper Fire Protection System Components Exposed Internally to Condensation</u>. SRP-LR Section 3.3.2.2.10.6 states that loss of material due to pitting and crevice corrosion may occur in copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.
The staff reviewed LRA Table 3.3.2-18, Fire Protection System, and noted that there were no copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. However, there are copper alloy components exposed to internal condensation in other systems.

The staff noted that the plant-specific program proposed by the applicant is the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL Report AMP XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components to which the applicant program is consistent, addresses only internal surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and amenable to the same types of visual inspections. Thus, corrosion on copper alloy internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to pitting and crevice corrosion in copper alloy piping and components exposed to internal condensation because, similar to the inspections performed on steel materials, the visual inspections on the other internal surfaces of metallic components will be capable of identifying any evidence of corrosion on the metal surfaces being inspected.

Buried Stainless Steel HVAC Components Exposed Internally to Soil. The SRP-LR Section 3.3.2.2.10 Paragraph 7 states that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil.

The staff noted that the systems at BVPS that have stainless steel piping components that are exposed to soil are the BVPS River Water (Unit 1 only) and Service Water (Unit 2 only). The staff noted that the applicant credits its Buried and Piping Tanks Inspection Program to manage loss of material due to pitting and crevice corrosion in the external surfaces that are to a buried soil environment. The staff finds the applicant’s basis for aging management to be acceptable because it is in agreement with the SRP-LR Section 3.3.2.2.10 Paragraph 7. The staff evaluates the capability of the Buried Piping and Tanks Inspection Program to aging in buried components in SER Section 3.3.3.1.8.

The staff noted that in LRA Table 3.3.2-14, Row 26 the applicant identifies glass piping exposed to soil and the table indicates there is no aging effect requiring management and, therefore, no aging management program. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation.

Stainless Steel Piping Components in BWR Standby Liquid Control Systems. LRA Section 3.3.2.2.10.8 states that the recommended aging management guidance in SRP-LR Section 3.1.2.2.10.8 for BWR standby liquid control systems is not applicable to the BVPS LRA.

SRP-LR Section 3.3.2.2.10.8 identifies that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements of the BWR standby liquid control systems that are exposed to sodium pentaborate solutions, and that the existing aging management program relies on monitoring and control of water chemistry to manage the aging effects of loss of material due to pitting and crevice corrosion. The SRP-LR Section states, however, that high concentrations of impurities at crevices and locations of stagnant flow conditions could cause loss of material due to pitting and crevice corrosion, and that as a result, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure this aging is not occurring. The SRP-LR Section states that a one-time inspection of select components at susceptible locations is an acceptable method to ensure that loss of material due to pitting and crevice corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff concludes that the guidance in SRP-LR Section 3.3.2.2.10.8 is not applicable to the BVPS LRA because the staff's recommended AMR in GALL AMR VII.E2-1 and aging management guidance in SRP-LR Section 3.3.2.2.10.8 is only applicable to stainless steel piping, piping components, and piping elements in BWR standby liquid control systems that are exposed to sodium pentaborate solutions, and because the BVPS units are Westinghouse-designed PWRs, which do not have these systems.

3.3.2.2.11 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion

SRP-LR Section 3.3.2.2.11 states "that loss of material due to pitting, crevice, and galvanic corrosion could occur for copper alloy piping, piping components, and piping elements exposed to treated water. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that this aging effect is not occurring. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that loss of material due to pitting and crevice corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation."

The staff noted that the AMPs proposed by the applicant in LRA Section B.2.42 and B.2.30 to manage this aging effect is the Water Chemistry Program and the One-Time Inspection Program. The staff also noted that this item is applicable to BWRs. However the aging comparison to this BWR item is appropriate for treated (unborated water) systems in PWRs when no comparable PWR item is available.

The staff reviewed the Water Chemistry Program and finds that it provides for the monitoring and controlling of water chemistry using site procedures and processes for the prevention or mitigation of the loss of material. The staff's evaluation of the Water Chemistry Program is documented in SER Section 3.0.3.2.14. On this basis the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting and crevice corrosion in copper alloy piping, piping components, and piping elements exposed to treated water during the period of extended operation.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to confirm that loss of material due to pitting and crevice corrosion in copper alloy piping, piping components, and piping elements exposed to treated water is managed during the period of extended operation.

3.3.2.2.12 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced (MIC) Corrosion

Stainless Steel, Aluminum, and Copper Components Exposed to Fuel Oil. SRP-LR Section 3.3.2.2.12.1 states that "loss of material due to pitting, crevice, and MIC could occur in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil. The existing aging management program relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion. However, corrosion may occur at locations where contaminants accumulate and the effectiveness of fuel oil chemistry control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the fuel oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation."

The staff noted that the applicant proposed in LRA Section B.2.30 that the One-Time Inspection Program verify the effectiveness of the Fuel Oil Chemistry Program.

The staff reviewed the Fuel Oil Chemistry Program and finds that it maintains fuel oil quality by monitoring and controlling fuel oil contamination in accordance with the plant's Technical Specifications and the guidelines of the American Society for Testing Materials. Exposure to fuel oil contaminants, such as water and microbiological organisms, is minimized by periodic draining or cleaning of tanks and by verifying the quality of new oil before its introduction into the storage tanks. The staff's evaluation of the Fuel Oil Chemistry Program is documented in SER Section 3.0.3.2.8. On this basis the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting, crevice, and MIC in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil during the period of extended operation.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and adequately confirms that the Fuel Oil Chemistry Program will manage loss of material due to pitting, crevice, and MIC in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil during the period of extended operation.

Stainless Steel, Aluminum, and Copper Components Exposed to Lubricating Oil. SRP-LR Section 3.3.2.2.12.2 states that "loss of material due to pitting, crevice, and MIC could occur in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on the control of lubricating oil program for monitoring and control of lubricating oil contamination to maintain contaminants within acceptable limits. The effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation."

The staff noted that the applicant proposed in LRA Section B.2.30 that the One-Time Inspection Program to verify the effectiveness of the Lubricating Oil Analysis Program.

The staff reviewed the Lubricating Oil Analysis Program and finds that it maintains oil systems contaminants (primarily water and particulates) within acceptable limits, thereby preserving an environment that is not conducive to loss of material due to general, pitting, crevice, MIC, and fouling that could occur for steel heat exchanger components exposed to lubricating oil. The staff's evaluation of the Lubricating Oil Analysis Program is documented in SER Section 3.0.3.1.13. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting, crevice, and MIC in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to lubricating oil.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and adequately confirms that the Lubricating Oil Analysis Program will manage loss of material due to pitting, crevice, and MIC in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to lubricating oil during the period of extended operation.

3.3.2.2.13 Loss of Material Due to Wear

LRA Section 3.3.2.2.13 addresses the applicant's evaluation and basis for managing loss of material due to wear in elastomeric seals and components that are exposed to (either internally or externally) uncontrolled indoor air. In this Section of the LRA, the applicant states that the BVPS AMR methodology did not specifically identify loss of material due to wear as an aging effect requiring management (AERM) for elastomeric seals or components in the auxiliary systems under internal exposure to indoor air or external exposure to indoor air.

SRP-LR Section 3.3.2.2.13 states that loss of material due wear may occur in elastomeric auxiliary system seals or components that are either exposed internally to indoor air or externally to indoor air. The SRP-LR recommends further evaluation of these aging effects to ensure that they are adequately managed during the period of extended operation.

SRP-LR Section 3.3.2.2.13 invokes AMR Item 34 in Table 3 of the GALL Report, Volume 1, and AMR Items VII.F1-5, VII.F2-5, VII.F3-5 and VII.F4-4 in the GALL Report, Volume 2, as applicable to external elastomeric seal or component surfaces in control room area ventilation systems, auxiliary and radwaste ventilation systems, primary containment heating and ventilation systems, and diesel generator ventilation systems under exposure to indoor air, and

GALL AMR Items VII.F1-6, VII.F2-6, VII.F3-6 and VII.F4-5 in the GALL Report, Volume 2, as applicable to internal elastomeric seal or component surfaces in control room area ventilation systems, auxiliary and radwaste ventilation systems, primary containment heating and ventilation systems, and diesel generator ventilation systems under exposure to indoor air.

In these AMRs, the staff identifies that loss of materials due to wear may occur in the elastomeric surfaces that are exposed to uncontrolled indoor air and recommends that a plant-specific aging management program is to be evaluated.

The staff reviewed LRA Section 3.3.2.2.13 against the staff's recommended regulatory criteria in SRP-LR Section 3.3.2.2.13. The staff noted the LRA Table 3.3.2-1, "Area Ventilation Systems – Control Area – Summary of Aging Management Evaluation," did not include any AMR items that align to GALL Report AMR VII.F1-5 and VII.F1-6 for management of loss of material due to wear in internal and external elastomer seal or component surfaces of the control area ventilation system under exposure to indoor air. The staff also noted that LRA Table 3.3.2-2, "Area Ventilation Systems – Plant Areas – Summary of Aging Management Evaluation," did not include any AMR items aligning to GALL Report AMRs VII.F2-5, VII.F2-6, VII.F3-5, VII.F3-6, VII.F4-4, and VII.F4-5 for management of loss of material due to wear in internal and external elastomer seal surfaces of the auxiliary and radwaste ventilation systems, primary containment heating and ventilation systems, and diesel generator ventilation systems (that in balance of plant systems) under exposure to indoor air.

The applicant did not provide any technical basis in the application why loss of material due to wear is not an applicable aging effect requiring management (AERM) for the elastomeric seals or components in the applicant's control area ventilation system or other plant-area ventilation systems that are exposed indoor air on either their internal or external surfaces. In RAI 3.3.2.2.13-1, the staff asked to provide a technical basis why the elastomeric seals or components in these systems would not be subject to the mechanical aging mechanism of wear or abrasion and why GALL Report AMR items VII.F1-5, VII.F2-5, VII.F3-5 and VII.F4-4 in the GALL Report, Volume 2 (as applicable management of loss of material/wear in external elastomeric seal or component surfaces in control room area ventilation systems, auxiliary and radwaste ventilation systems, primary containment heating and ventilation systems, and diesel generator ventilation systems under exposure to indoor air) and GALL Report AMR Items VII.F1-6, VII.F2-6, VII.F3-6 and VII.F4-5 in the GALL Report, Volume 2 (as applicable to the management of loss of material/wear in internal elastomeric seal or component surfaces in control room area ventilation systems, auxiliary and radwaste ventilation systems, primary containment heating and ventilation systems, and diesel generator ventilation systems under exposure to indoor air) are not applicable to the BVPS LRA.

The applicant responded to RAI 3.3.2.2.13-1 in a letter dated July 21, 2008. In its response dated July 21, 2008, the applicant stated that it used the EPRI Mechanical Tools and EPRI-1002950, "Aging Effects for Structures and Structural Components (Structural Tools)," supplemented by operating experience reviews, to identify potential aging effects for material-environment combinations. In the EPRI Mechanical and Structural Tools, "wear" is evaluated as a design consideration, rather than an aging effect. The applicant explained that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended of operation and be corrected. As such, it is expected that loss of material due to wear or fretting from normal plant operations is insufficient to result in loss of component function during the period of extended operation. The applicant further stated that the EPRI Tools do not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but recommends plant-specific consideration for the potential that loss of material due to wear may occur. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric components for which loss of material due to wear was determined to be an additional aging effect that required management.

In its response dated July 21, 2008, the applicant also stated that it did not identify loss of material due to wear to be an applicable aging effect requiring management for elastomeric components. As a result, the applicant clarified that GALL Report AMR items VII.F1-5, VII.F1-6, VII.F2-5, VII.F2-6, VII.F3-5, VII.F3-6, VII.F4-4, and VII.F4-5, which all address loss of material due to wear for elastomers, are not applicable to the BVPS LRA. The applicant further explained however, that the aging effects of "Cracking" and "Hardening and loss of strength" were identified as aging effects requiring management for the external surfaces of elastomeric flexible ventilation connections that are subject to aging management review. The applicant referenced its response to RAI-3.3.2.3-1/3.4.2.3-1, which stated that other elastomeric components in LRA Sections 3.1, 3.2, 3.3, and 3.4 will be addressed by repetitive maintenance tasks such that they are classified as "short-lived" and are therefore not subject to aging management review per 10 CFR 54.21(a)(1)(ii). Since wear is a loss of material-inducing mechanism that impacts the surfaces of the components on which it acts, the staff finds that the visual examinations of the elastomeric flexible ventilation connections will also be capable of detecting any loss of material that may occur in the surfaces of these elastomeric components as a result of potential impacts by wear. 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 line 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 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).

3.3.2.2.14 Loss of Material Due to Cladding Breach

LRA Section 3.3.2.2.14 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.3.2.2.14, "Loss of Material Due to Cladding Breach," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that loss of material of the BVPS charging pump casings is not applicable to the BVPS design because the charging pump casings are fabricated from entirely from stainless steel and not from steel with stainless steel cladding.

SRP-LR Section 3.3.2.2.14 provides the following guidance on management of loss of material in steel charging pumps with internal stainless steel cladding:

> "Loss of material due to cladding breach could occur for PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The GALL Report references NRC Information Notice 94-63, Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks, and recommends further evaluation of a plant-specific aging management program to

> ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR)."

SRP-LR Section 3.3.2.2.14 invokes AMR Item 35 in Table 3 of the GALL Report, Volume 1, and AMR item VII.E1-21 in the GALL Report Volume 2, as applicable to the management of loss of material due to cladding breach in steel charging pumps designed with internal stainless steel cladding. For PWRs designed with this type of charging pumps, the staff recommends that plant-specific aging management program be evaluated and credited to manage this type of aging phenomenon.

The staff reviewed the assessment in LRA Section 3.3.2.2.14 against the staff's recommended regulatory criteria in AMR Item 35 in Table 3 of the GALL Report, Volume 1, and AMR item VII.E1-21 in the GALL Report Volume 2, as applicable to the management of loss of material due to cladding breach in steel charging pumps designed with internal stainless steel cladding.

The staff reviewed the information in LRA Table 3.3.2-5 and verified that in this table the applicant identifies that the BVPS charging pumps are fabricated entirely from cast austenitic stainless steel and are exposed internally to borated treated water, and externally to an uncontrolled indoor air environment. The staff also verified that in this table, the applicant identified that there are not any aging effects associated with the CASS charging pump casings as a result of exposure of the casings to borated water leakage.

Industry experience has demonstrated that exposure of steel components (i.e. those fabricated from carbon steel, alloy steel, or cast iron materials) to borated treated water sources may result in corrosive wastage of the steel materials. For PWR that are designed with steel charging pumps, the charging pump designs including stainless steel cladding on the internal surfaces of the steel pump casings, which is designed to protect the steel material from being exposed directly to the borated treated water environment of the primary coolant. In NRC Information Notice (IN) 94-63, dated August 30, 1994, the staff alerted the U.S. PWR industry of a boric acid corrosion event that occurred at the North Anna Unit 1 nuclear plant.

In this IN, the staff identified that the licensee for the North Anna Unit 1 nuclear plant had reported that through-wall cracking in the cladding of the unit's steel charging pumps had resulted in exposure of the steel pump casing material to the borated treated water environment of the primary coolant and in a small boric-acid induced cavity in the steel pump casing material.

The staff has verified that in LRA Table 3.3.2-5, the applicant identifies that the BVPS charging pumps are entirely fabricated from CASS materials. For components made from stainless steel materials (including CASS), GALL Report AMR VII.J-16 identifies that boric acid corrosion is not an applicable aging effect for stainless steel surfaces that might be exposed to borated water leaks. Thus, consistent with the information in IN 94-63 and GALL Report AMR VII.J-16, the staff finds that the loss of material due to cladding breach (i.e. due to borated water leakage) is not applicable to the design of the BVPS charging pumps and that the applicant has provided an acceptable basis for concluding that guidance in LRA Section 3.3.2.2.14; AMR Item 35 in Table 3 of the GALL Report, Volume 1; and AMR item VII.E1-21 in the GALL Report, Volume 2 is not applicable to the BVPS LRA.

The staff also verified that, in LRA Table 3.3.2-5, the applicant does include an AMR that identifies loss of material as an applicable aging effect requiring management for the CASS charging pump casings. The staff also verified that, in this AMR, the applicant credits its Water Chemistry Program to manage loss of material that may occur in charging pump casings as a result of pitting or crevice corrosion. The staff verified that this AMR is entirely consistent with the staff's guidance in GALL AMR item VII.E1-17. The staff evaluates that AMR item in SER Section 3.3.2.1.

Based on the programs identified above, the staff concludes that the applicant has an acceptable basis for concluding that the LRA Section 3.3.2.2.14; AMR Item 35 in Table 3 of the GALL Report, Volume 1; and AMR item VII.E1-21 in the GALL Report, Volume 2 are not applicable to the BVPS LRA.

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 through J, which the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.3.2.3.1 Area Ventilation System - Control Area - Summary of Aging Management Evaluation – LRA Table 3.3.2-1

The staff reviewed LRA Table 3.3.2-1, which summarizes the results of AMR evaluations for the area ventilation system - control area component groups.

In LRA Table 3.3.2-1, the applicant proposed to manage reduction of heat transfer of the copper alloy <15% Zn heat exchanger exposed to condensation external environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. For these components the applicant cites generic Note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. LRA Section B.2.22 describes this program, which is credited for managing the aging effects of loss of material. The LRA states that this program is consistent with GALL Report AMP XI.M38. However, GALL Report AMP XI.M38 is recommended for managing the aging effect of loss of material of carbon steel components only. The staff issued RAI 3.3-A to request justification for using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage reduction of heat transfer in copper alloy < 15% Zn heat exchanger components.

The applicant responded to RAI 3.3-A in a letter dated October 3, 2008. In this letter, the applicant responded that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages the aging effect of reduction of heat transfer by performing visual inspection for accumulation of dirt and debris on heat transfer surfaces. The applicant also stated that fouling is specifically included in the GALL Report AMP XI.M38 in “monitoring and trending” and “acceptance criteria” elements.

The staff reviewed the GALL Report AMP XI.M38 elements and noted the “monitoring and trending” element states that results of the periodic inspections are monitored for indications of corrosion and fouling; and the “acceptance criteria” element states that indications of fouling that would impact component intended function are reported and will require further evaluation. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspection for accumulation of dirt and debris, and that this program is consistent with the GALL Report AMP XI.M38, the staff finds the applicant response acceptable. The staff concludes that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will adequately manage the aging effects of reduction of heat transfer of the copper alloy <15% Zn heat exchanger exposed to condensation external environment during the period of extended operation.

In LRA Table 3.3.2-1, the applicant proposed to manage loss of material of the gray cast iron heat exchanger (waterbox) exposed to condensation – external using the Selective Leaching of Materials Inspection Program (B.2.36). The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.3.6. The applicant clarified external condenstation is not an environment covered in the GALL Report. However, the applicant clarified that there are similar environments covered in the GALL Report for gray cast iron where loss of material is the aging effect requiring management and the GALL Report recommends that GALL Report AMP XI.M33 “Selective Leaching of Materials,” be credited as the AMP for managing loss of material by selective leaching. Because external condensation can created a wette environment similar to other water-based environments listed in the GALL Report (e.g., treated water, raw water, and closed cycle cooling water), the staff finds the applicant’s basis for crediting the Selective Leaching of Materials Inspection Program for aging management of loss of material by selective leaching to be acceptable.

In LRA Table 3.3.2-1, the applicant included its plant-specific AMR for managing cracking of the elastomeric flexible connections exposed to indoor uncontrolled air and indoor uncontrolled air-EXT environment using the External Surface Monitoring Program.

The staff reviewed the applicant’s plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with the GALL Report Volume 2 Table IX.F.

The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of flexible connection exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant's External Surfaces Monitoring Program is GALL Report AMP XI.M36, "External Surfaces Monitoring." The staff reviewed the program description and program elements for GALL Report AMP XI.M36 and noted that the scope of GALL Report AMP XI.M36, "External Surfaces Monitoring," is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL Report AMP XI.M36, "External Surfaces Monitoring," does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, "External Surfaces Monitoring," does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant's program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing cracking. The applicant's program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in elastomeric components.

In its response dated July 21, 2008, the applicant explained that in regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, "External Surfaces Monitoring. The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers in noticed (such as a change in strength or hardness of the material)

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, the based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surfaces Monitoring Program. The External Surfaces Monitoring Program will be representative of the conditions on the internal surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant’s letter of July 21, 2008. Based on the applicant’s response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant’s augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff’s concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

In LRA Table 3.3.2-1, the applicant provided its AMR on elastomeric flexible ventilation connections in the control area ventilation system that are exposed externally to an air with borated water leakage environment. In this AMR, the applicant identified that there are not any aging effects requiring management for the component surfaces that are exposed to this environment.

The staff reviewed the applicant's plant-specific AMR for this elastomeric flexible ventilation components. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for these components under external exposure to a borated water leakage environment. The staff issued RAI 3.3.2.3-3/3.4.2.3-3 to request identification of the specific elastomeric materials that were used in fabrication of the elastomeric components listed in these auxiliary AMR items (and for the flexible hoses in the auxiliary feedwater systems) and to provide a more detailed technical basis on whether there are any AERMs for the component-elastomer material-environment combinations in this AMR.

The applicant responded to RAI 3.3.2.3-3/3.4.2.3-3 in a letter dated July 21, 2008. With respect to the applicant's response for elastomeric flexible connection components in the control area and plant area ventilation systems (i.e. flexible ventilation connection components) the applicant explained that the components will remain categorized as "long-lived" and will remain subject to aging management review. The applicant also clarified that the elastomeric flexible ventilation connection components are fabricated from fiberglass that is coated with neoprene (polychloroprene) on both the internal and external fiberglass surfaces. The staff reviewed the applicant's response, and finds that it adequately resolved the question asked in the RAI, because the response clearly identified the elastomeric material that was used to fabricate the elastomeric components mentioned in these plant-specific AMR item. RAI 3.3.2.3-3/3.4.2.3-3, Part 1 is resolved.

In its response to RAI 3.3.2.3-3/3.4.2.3-3, the applicant also stated that according to the EPRI Structural Tools, Section 7.1.1:

> "Neoprene is chemically and structurally similar to natural rubber, and its mechanical properties are also similar. This resistance to oils, chemicals, sunlight, weathering, aging and ozone is outstanding. It retains its properties at temperatures up to 250°F."

The applicant further explained that the EPRI Structural Tools identifies various changes in elastomer properties that corresponded to the aging effects identified as "cracking" and as "hardening and loss of strength" in the GALL Report, and that the environmental conditions that might result in these aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant clarified that neoprene is relatively insensitive to temperature, ozone, and ultraviolet and ionizing radiation exposure, but it the potential for the GALL Report aging effects of "cracking and "hardening and loss of strength" was not excluded for neoprene aging evaluations. The applicant explained that it assigned both "Air-indoor uncontrolled" and "Air with borated water leakage" environments to in-scope components in areas containing borated water systems. Where the external environment of "Air with borated water leakage" exists, the environment of "Air-indoor uncontrolled" is also evaluated. However, the applicant clarified that the presence of boric acid leakage does not result in additional aging effects for elastomers in general or neoprene specifically, and that as a result of these determination, no additional aging effects were identified for the neoprene surfaces that are associated specifically with an air with borated water leakage environment.

The staff noted that the aging effects identified by the applicant for these elastomeric flexible ventilation connection components were consistent with the aging effects for elastomeric components listed in Section VII of the GALL Report, Volume 2. Based on this review, the staff finds that it adequately resolved the staff's inquiry on the aging effects that are applicable to these elastomeric components because the applicant has identified cracking and changes in the hardness or strength properties are the applicable aging effects requiring management (AERMs) for the surfaces that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water and because the staff has verified that this is in conformance with the applicable aging effects that are listed for elastomeric components in the AMRs of Section VII of the GALL Report, Volume 2.

The staff noted that for the elastomeric flexible ventilation connection components in the BVPS control area and plant area ventilation systems, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in hardness or strength of the elastomeric flexible ventilation connection components. The staff also noted, that in the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2, dated July 21, 2008, the applicant clarified that the visual examinations of these flexible ventilation connection components would be supplemented by physical manipulations of the components in order to aid with the identification of cracking or any changes in the hardness or strength properties of the components.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests of these elastomeric components in the applicant's letter of July 21, 2008. Based on the applicant's response to RAIs 3.3.2.3-2/3.4.2.3-2 and 3.3.2.3-3/3.4.2.3-3 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concerns and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing cracking in the components or any significant changes in the hardness or strength properties of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concerns in RAI 3.3.2.3-2/3.4.2.3-2 and RAI 3.3.2.3-3/3.4.2.3-3 are resolved relative to these AMRs.

In LRA Table 3.3.2-1, the applicant provided its AMR for polymeric filter housings that are exposed to dried air and indoor uncontrolled air-EXT experiences. In these AMRs the applicant identified that there are not any aging effects requiring management (AERMs) for the polymeric components surfaces that are exposed to either a dried air and indoor uncontrolled air environment, and therefore these polymeric components do not require that an AMP be credited for aging management.

The staff reviewed the applicant's plant-specific AMRs for these polymeric filter housings The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for the polymer components surfaces that are exposed to either dried air or an indoor uncontrolled air environment. The staff issued RAI 3.3.2.3-4 to request identification of the specific polymer materials that were used in fabrication of the components and to provide a more detailed technical basis on whether there are any AERMs for the component-polymer material-environment combinations in these AMRs.

The applicant responded to RAI 3.3.2.3-4 in a letter dated July 21, 2008. In this letter, the applicant explained that it has reviewed details associated with the various polymer components addressed in the LRA. The applicant stated that, to address the issue of these polymeric filter housings, the BVPS LRA is revised to include a Commitment No. 28 on UFSAR Supplement Table A4-1 for Unit 1 and Commitment No. 27 on UFSAR Supplement Table A5-1 for Unit 2. The applicant stated that for these polymeric filter housings, the applicant commits to performing periodic maintenance tasks prior to the period of extended operation and to periodically replace the polymeric components such that they are classified as "short-lived" and such that they are subject to aging management under the requirements of 10 CFR 54.21 (a)(1)(ii). The applicant also stated that the frequency of the repetitive tasks and replacement activities will be determined based upon manufacturer recommendations and operating experience. The staff verified that, in the letter of July 21, 2008, the applicant amended the UFSAR Supplement to place Commitment No. 28 on UFSAR Supplement Table A4-1 for Unit 1 and Commitment No. 27 on UFSAR Supplement Table A5-1 for Unit 2 on the applicant. Based on this review, the staff finds that the applicant has provided an acceptable basis for amending the LRA to delete the AMRs for the polymeric filter housings in the control area ventilations systems because the applicant's basis in compliance with staff's AMR screening requirements in 10 CFR 54.21 (a)(1)(ii) and in conformance with the staff's AMR screening guidance in SRP-LR Section 2.1.3.2.2. Therefore, the staff's concern in RAI 3.3.2.3-4 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.2 Area Ventilation System - Plant Areas - Summary of Aging Management Evaluation – LRA Table 3.3.2-2

The staff reviewed LRA Table 3.3.2-2, which summarizes the results of AMR evaluations for the area ventilation system - plant areas component groups.

In LRA Table 3.3.2-2, the applicant included its plant-specific AMR item for managing loss of material in the external surfaces of gray cast iron heat exchanger condenser channels and copper > 15% zinc heat exchanger tubes, valve bodies, and flexible hoses under exposure to a condensation environment. In these AMRs, the applicant identified that selective leaching of the component materials is the applicable aging mechanism that leads to loss of material of the components and that the Selective Leaching Program is credited to manage loss of material of the components as a result of selective leaching.

The staff noted that in other AMRs (e.g. GALL AMR items VII.E4-9 and VII.E4-10) on selective leaching of components made from cast iron and copper with greater than 15% alloying zinc content, the staff recommends that a program corresponding to GALL AMP XI.M33, “Selective Leaching of Materials,” be credited for aging management of selective leaching in the components. The staff therefore finds the applicant’s aging management basis for these components to be acceptable because it is in conformance with the staff’s recommended AMR position in GALL AMR items VII.E4-9 and VII.E4-10, with the exception that the wetted environment for these stated components is a condensation environment instead of treated water. The staff’s evaluation of the applicant’s Selective Leaching Program is given in SER Section 3.0.3.3.6.

In LRA Table 3.3.2-2, the applicant proposed to manage reduction of heat transfer of stainless steel heat exchangers exposed to condensation external environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. For these components the applicant cites generic Note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. LRA Section B.2.22 describes this program, which is credited for managing the aging effects of loss of material. The LRA states that this program is consistent with GALL AMP XI.M38. However, GALL AMP XI.M38 is recommended for managing the aging effect of loss of material of carbon steel components only. The staff issued RAI 3.3-A to request justification for using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage reduction of heat transfer.

The applicant responded to RAI 3.3-A in a letter dated October 3, 2008. In this letter, the applicant responded that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages the aging effect of reduction of heat transfer by performing visual inspection for accumulation of dirt and debris on heat transfer surfaces. The applicant also stated that fouling is specifically included in the GALL AMP XI.M38 in “monitoring and trending” and “acceptance criteria” elements.

The staff reviewed the GALL AMP XI.M38 elements and noted the “monitoring and trending” element states that results of the periodic inspections are monitored for indications of corrosion and fouling; and the “acceptance criteria” element states that indications of fouling that would impact component intended function are reported and will require further evaluation. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspection for accumulation of dirt and debris, and that this program is consistent with the GALL AMP XI.M38, the staff finds the applicant response acceptable. The staff concludes that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will adequately manage the aging effects of reduction of heat transfer of the stainless steel heat exchangers exposed to condensation external environment during the period of extended operation.

In LRA Table 3.3.2-2, the applicant provides its plant-specific AMR items for managing cracking of the elastomeric flexible connections in the plant area ventilation systems under external or internal exposure to indoor uncontrolled air environments. In these AMR items, the applicant credits its External Surface Monitoring Program to manage cracking in the component surfaces that are exposed to these environments.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.3 Boron Recovery and Primary Grade Water System - Summary of Aging Management Evaluation – LRA Table 3.3.2-3

The staff reviewed LRA Table 3.3.2-3, which summarizes the results of AMR evaluations for the boron recovery and primary grade water system component groups.

In LRA table 3.3.2-3, the applicant proposed that glass sight glass exposed to air with borated water leakage-external would have no aging effect requiring management and, there would be no aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.4 Building and Yard Drains System - Summary of Aging Management Evaluation – LRA Table 3.3.2-4

The staff reviewed LRA Table 3.3.2-4, which summarizes the results of AMR evaluations for the building and yard drains system component groups.

In LRA Table 3.3.2-4, the applicant included its plant-specific AMR for managing loss of material in the copper alloy > 15% Zn piping, and valve bodies and gray cast iron tanks of the building and yard drain systems that are exposed to a condensation environment. In these AMRs, the applicant credited its Selective Leaching of Materials Inspection Program (B.2.36) to manage loss of material of the components as a result of selective leaching. The staff noted that in other

AMRs (e.g. GALL AMR items VII.E4-9 and VII.E4-10) on selective leaching of components made from cast iron and copper with greater than 15% alloying zinc content, the staff recommends that a program corresponding to GALL AMP XI.M33, “Selective Leaching of Materials,” be credited for aging management of selective leaching in the components. The staff therefore finds the applicant’s aging management basis for these components to be acceptable because it is in conformance with the staff’s recommended AMR position in GALL AMR items VII.E4-9 and VII.E4-10, with the exception that the wetted environment for these stated components is a condensation environment instead of treated water. The staff’s evaluation of the applicant’s Selective Leaching Program is given in SER Section 3.0.3.3.6

In LRA table 3.3.2-4, the applicant proposed that sight glass exposed to condensation would have no aging effect requiring management and, there would be no aging management program. Condensation is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In LRA table 3.3.2-4, the applicant proposed that glass sight glasses exposed to air with borated water leakage-external would have no aging effect requiring management and, there would be no aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.5 Chemical and Volume Control System - Summary of Aging Management Evaluation – LRA Table 3.3.2-5

The staff reviewed LRA Table 3.3.2-5, which summarizes the results of AMR evaluations for the chemical and volume control system component groups.

In LRA Table 3.3.2-5, the applicant proposed to manage cumulative fatigue damage of stainless steel bolting exposed to uncontrolled indoor air on the external surface as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA table 3.3.2-5, the applicant proposed that for glass sight glasse exposed to condensation would have no aging effect requiring management and, there would be no aging management program. Condensation is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In these LRA table 3.3.2-5, the applicant proposed that for sight glasse exposed to air with borated water leakage-external would have no aging effect requiring management and, there would be no aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-5, the applicant proposed to manage reduction of heat transfer in stainless steel heat exchanger (excess letdown seal water – tube) exposed to treated borated water using a combination of the Water Chemistry Program (B.2.42) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The Water Chemistry Program was reviewed by the staff in SER Section 3.0.3.2.14. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Reduction of heat transfer is not an aging effect covered in the GALL Report for stainless steel heat exchanger tubes or other heat transfer surfaces exposed to treated borated water. However, the staff's evaluation of the Water Chemistry Program finds that it would maintain treated water quality through treatment and testing. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-5, the applicant proposed to manage reduction of heat transfer in copper alloy <15% Zn heat exchanger (oil cooler - tube) exposed to lubricating oil – EXT using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Reduction of heat transfer is not an aging effect covered in the GALL Report for copper alloy <15% Zn heat exchanger tubes or other heat transfer surfaces exposed to lubricating oil. However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-5, the applicant proposed to manage reduction of heat transfer in stainless steel heat exchanger (Unit 1 and Unit 2 non-regen – tube) and stainless steel heat exchanger (unit 1 and unit 2 regen HX – tube) exposed to treated water >60°C (>140°F) using a combination of the Water Chemistry Program (B.2.42) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The Water Chemistry Program was reviewed by the staff in SER Section 3.0.3.2.14. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Reduction of heat transfer is not an aging effect covered in the GALL Report for stainless steel heat exchanger tubes or other heat transfer surfaces exposed to treated water. However, the staff's evaluation of the Water Chemistry Program finds that it would maintain treated water quality through treatment and testing. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-5, the applicant proposed to manage cracking of the elastomeric sight glasses exposed to indoor uncontrolled air and indoor uncontrolled air-EXT environment using the External Surface Monitoring Program.

The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review, the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F.

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.

The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21, 2008, the applicant explained that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to

RAI-3.3.2.3-3 / 3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as “short-lived” and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components and because this meets that staff’s LRA screening basis in 10 CFR 54.21(a)(1)(ii) that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, “wear” is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that as such, loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluated the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant’s basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking. The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of “change in material properties.” The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, volume 2), Section IX.F, “Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms,” the staff groups “weathering” as an aging mechanism within the scope of the grouping “Elastomer degradation,” and defines "weathering" as “Degradation of external surfaces of materials when exposed to outside environment.” The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, do not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant’s UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicants response and finds that, chemical degradation of elastomer components in contact a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated “short-lived.” On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), “short-lived” components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect “wear” is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant’s review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant’s response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.6 Chilled Water System - Summary of Aging Management Evaluation – LRA Table 3.3.2-6

The staff reviewed LRA Table 3.3.2-6, which summarizes the results of AMR evaluations for the chilled water system component groups.

In these LRA tables, the applicant proposed for these systems that sight glass exposed to condensation would have no aging effect requiring management and, there would be no aging management program. Condensation is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. For this reason, the staff finds that these line items are acceptable.

In these LRA tables, the applicant proposed for these systems that sight glasses exposed to closed cycle cooling water would have no aging effect requiring management and, there would be no aging management program. The combination of glass and closed cycle cooling water is not a material/environment combination covered in GALL. However, there are similar material/environment combinations covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-6, the applicant proposed to manage loss of material in copper alloy >15% Zn heat exchanger (cooling coil) and gray cast iron heat exchanger (header) exposed to condensation – EXT using the Selective Leaching of Materials Inspection Program (B.2.36). During its review, the staff noted that the applicant applied Note H to this item. The staff reviewed the AMR results line that reference Note H. The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.2.12. Loss of material is not an aging effect covered in the GALL Report for copper alloy >15% Zn and grey cast iron heat exchanger components exposed to an external environment of condensation. However, the staff's evaluation of the Selective Leaching of Materials Inspection Program finds that it would be effective in identifying evidence of loss of material signifying that this aging effect is occurring. Therefore, the staff finds that this line item is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.7 Compressed Air System - Summary of Aging Management Evaluation – LRA Table 3.3.2-7

The staff reviewed LRA Table 3.3.2-7, which summarizes the results of AMR evaluations for the compressed air system component groups.

In LRA Table 3.3.2-7, the applicant proposed to manage cumulative fatigue damage of stainless steel piping and flexible hoses exposed to diesel exhaust as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In this LRA table 3.3.2-7, the applicant proposed that sight glass exposed to condensation would have no aging effect requiring management and, there would be no aging management program. Condensation is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In this LRA table 3.3.2-7, the applicant proposed that sight glass exposed to air with borated water leakage-external would have no aging effect requiring management and, there would be no aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-7, the applicant proposed to manage loss of material of the copper alloy > 15% Zn valve bodys exposed to condensation – external using the Selective Leaching of Materials Inspection Program (B.2.36). The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.z. Condenstation – external is not an environment covered in the GALL Report. However, there are similar environments covered in the GALL Report for copper alloy >15% Zn where loss of material is the aging effect requiring management and Selective Leaching of Materials (XI.M33) is the AMP. Because the environment, condensation - external, is similar to environments listed in the GALL Report, such as treated water, raw water, and closed cycle cooling water, the staff finds that this line item is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.8 Containment System - Summary of Aging Management Evaluation – LRA Table 3.3.2-8

The staff reviewed LRA Table 3.3.2-8, which summarizes the results of AMR evaluations for the containment system component groups.

In Table 3.3.2-8, the applicant identified no aging effects for stainless steel piping and valve body exposed to an exterior environment of outdoor air. For these components the applicant cites Note G, which indicates that environment is not in the GALL Report for this component and material. The staff finds that stainless steel material is susceptible to aging only if exposed to an aggressive chemical, salt water or buried environments. In a normal atmosphere environment, where rain water would tend to wash the exterior surface material rather than concentrate contaminants, the stainless steel material will have no aging effects. The SCC in stainless steel, which is considered plausible in wetted corrosive environments with a temperature greater than 140 ºF, will not occur in the outside air environment. On this basis, the staff finds that stainless steel in an outside air environment exhibits no aging effect, and that the component or structure will remain capable of performing its intended functions consistent with the CLB during the period of extended operation.

In this LRA table 3.3.2-8, the applicant proposed that sight glass exposed to air with borated water leakage-external would have no aging effect requiring management and, there would be no aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report.
The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.9 Containment Vacuum and Leak Monitoring System - Summary of Aging Management Evaluation – LRA Table 3.3.2-9

The staff reviewed LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the containment vacuum and leak monitoring system component groups.

The staff reviewed LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the containment vacuum and leak monitoring system component groups.
In LRA Table 3.3.2-9, the applicant proposed to manage loss of material of the gray cast iron trap body exposed to condensation – external using the Selective Leaching of Materials Inspection Program (B.2.36). The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.z. Condensation – external is not an environment covered in the GALL Report. However, there are similar environments covered in the GALL Report for copper alloy >15% Zn and gray cast iron where loss of material is the aging effect requiring management and Selective Leaching of Materials (XI.M33) is the AMP. Because the environment, condensation, external is similar to environments listed in the GALL Report, such as treated water, raw water, and closed cycle cooling water, the staff finds that this line item is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.10 Domestic Water System - Summary of Aging Management Evaluation – LRA Table 3.3.2-10

The staff reviewed LRA Table 3.3.2-10, which summarizes the results of AMR evaluations for the domestic water system component groups.

In LRA Table 3.3.2-10, the applicant proposed to manage loss of material of the copper alloy > 15% Zn strainer bodies and valve bodies exposed to condensation – external using the Selective Leaching of Materials Inspection Program (B.2.36). The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.z. Condenstation – external is not an environment covered in GALL. However, there are similar environments covered in GALL for copper alloy >15% Zn where loss of material is the aging effect requiring management and Selective Leaching of Materials (XI.M33) is the AMP. Because the environment, condensation - external is similar to environments listed in the GALL Report, such as treated water, raw water, and closed cycle cooling water, the staff finds that this line item is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.11 Emergency Diesel Generators and Air Intake and Exhaust System - Summary of Aging Management Evaluation – LRA Table 3.3.2-11

The staff reviewed LRA Table 3.3.2-11, which summarizes the results of AMR evaluations for the emergency diesel generators and air intake and exhaust system component groups.

In LRA Table 3.3.2-11, the applicant proposed to manage cumulative fatigue damage of steel piping, exhaust silencer and turbocharger housing exposed to diesel exhaust as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.3.2-11, the applicant proposed to manage cumulative fatigue damage of stainless steel piping, expansion joint and flexible hoses exposed to diesel exhaust as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.3.2-11, the applicant proposed to manage reduction of heat transfer of the aluminum heat exchanger exposed to air –indoor uncontrolled environment using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. For these components the applicant cites generic Note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. LRA Section B.2.22 describes this program, which is credited for managing the aging effects of loss of material. The LRA states that this program is consistent with GALL AMP XI.M38. However, GALL AMP XI.M38 is recommended for managing the aging effect of loss of material of carbon steel components only. The staff issued RAI 3.3-A to request justification for using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage reduction of heat transfer.

The applicant responded to RAI 3.3-A in a letter dated October 3, 2008. In this letter, the applicant responded that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages the aging effect of reduction of heat transfer by performing visual inspection for accumulation of dirt and debris on heat transfer surfaces. The applicant also stated that fouling is specifically included in the GALL AMP XI.M38 in "monitoring and trending" and "acceptance criteria" elements.

The staff reviewed the GALL AMP XI.M38 elements and noted the "monitoring and trending" element states that results of the periodic inspections are monitored for indications of corrosion and fouling; and the "acceptance criteria" element states that indications of fouling that would impact component intended function are reported and will require further evaluation. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires visual inspection for accumulation of dirt and debris, and that this program is consistent with the GALL AMP XI.M38, the staff finds the applicant response acceptable. The staff concludes that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will adequately manage the aging effects of reduction of heat transfer of the aluminum heat exchanger exposed to air –indoor uncontrolled environment during the period of extended operation. RAI 3.3-A is resolved.

In LRA Table 3.3.2-11, the applicant proposed to manage cracking of the elastomeric expansion joints exposed to indoor uncontrolled air environment and indoor uncontrolled air-EXT using the External Surface Monitoring Program.

The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review, the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F.

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.

The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21, 2008, the applicant explained, that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components and because this meets that staff's LRA screening basis in 10 CFR 54.21(a)(1)(ii) that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, "wear" is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that as such, loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluated the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant's basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking. The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of "change in material properties." The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, volume 2), Section IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms," the staff groups "weathering" as an aging mechanism within the scope of the grouping "Elastomer degradation," and defines "weathering" as "Degradation of external surfaces of materials when exposed to outside environment." The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, do not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant's UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicants response and finds that, chemical degradation of elastomer components in contact a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated "short-lived." On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), "short-lived" components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect "wear" is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant's review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant's response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

Assessment of the Applicant's Aging Management Programs or Activities Credited for Aging Management. The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of elastomeric flexible ventilation connection components that are exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant's External Surfaces Monitoring Program is GALL AMP XI.M36, "External Surfaces Monitoring." The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, "External Surfaces Monitoring," is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, "External Surfaces Monitoring," does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, "External Surfaces Monitoring," does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant's program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing

cracking. The applicant's program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in: (1) the elastomeric auxiliary system components that are exposed, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed externally to uncontrolled indoor air.

In its response dated July 21, 2008, the applicant explained that, as identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the replacement activities will be determined based upon manufacturer recommendations and operating experience, and that the flexible hoses (non-flexible ventilation connection components) in the auxiliary feedwater system are, therefore, classified as short-lived and excluded from aging management review. The staff's basis for concluding that the non-flexible ventilation connection components in the auxiliary systems do not need to be subject to an AMR or to any AMPs for aging management has been discussed previously in the *Assessment of Applicable Aging Effects* portion of this evaluation

In regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, "External Surfaces Monitoring. The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers in noticed (such as a change in strength or hardness of the material).

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, the based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surfaces Monitoring Program. The External Surfaces Monitoring Program will be representative of the conditions on the internal surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant's letter of July 21, 2008. Based on the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.12 Emergency Diesel Generators - Air Start System - Summary of Aging Management Evaluation – LRA Table 3.3.2-12

The staff reviewed LRA Table 3.3.2-12, which summarizes the results of AMR evaluations for the emergency diesel generators - air start system component groups.

In LRA Table 3.3.2-12, the applicant proposed to manage cracking of the aluminum moisture separator exposed to condensation using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. For these components the applicant cites generic Note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. LRA Section B.2.22 describes this program, which is credited for managing the aging effects of loss of material. The LRA states that this program is consistent with GALL AMP XI.M38. However, GALL AMP XI.M38 is recommended for managing the aging effect of loss of material of carbon steel components only. The staff issued RAI 3.3-A was issued to request justification for using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage cracking.

The applicant responded to RAI 3.3-A in a letter dated October 3, 2008. In this letter, the applicant stated that the determination that cracking is a relevant aging effect for aluminum alloys is dependent upon the presence of zinc or magnesium above the threshold levels in the aluminum alloy. However, levels of zinc and magnesium above these thresholds (greater than 12% zinc and/or 6% magnesium) are not common in aluminum alloys, so the aging effect is not expected to occur. The applicant has amended the LRA to credit the One-Time Inspection Program to confirm the absence of cracking in these moisture separators, instead of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program that it had proposed in the LRA. The applicant revised Table 3.3.2-12, row 26, to delete the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and credited the One-Time Inspection Program. The applicant also revised the LRA AMP B.2.30, One-Time Inspection program description, “scope of program” and “detection of aging effects” elements to state that the One-Time Inspection Program will confirm the absence of cracking in these moisture separators.

The staff reviewed the One-Time Inspection Program and documented its evaluation in SER Section 3.0.3.1.17. The program is consistent with the GALL AMP XI.M32, One-Time Inspection. On the basis that cracking is not expected to occur in these aluminum alloys, and the One-Time Inspection Program has been amended included the moisture separators and will be used to confirm the absence of cracking in these moisture separators, the staff finds the applicant response acceptable, and concludes that the One-Time Inspection Program will adequately manage the aging effects of cracking in aluminum moisture separators during the period of extended operation.

In LRA Table 3.3.2-12, the applicant proposed to manage loss of material of the copper alloy > 15% Zn valve bodys exposed to condensation – external using the Selective Leaching of Materials Inspection Program (B.2.36). The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.z. Condenstation – external is not an environment covered in the GALL Report. However, there are similar environments covered in the GALL Report for copper alloy >15% Zn where loss of material is the aging effect requiring management and Selective Leaching of Materials (XI.M33) is the AMP. Because the environment, condensation - external is similar to environments listed in the GALL Report, such as treated water, raw water, and closed cycle cooling water, the staff finds that this line item is acceptable.

In LRA Table 3.3.2-12, the applicant proposed to manage cracking of the elastomeric flexible hoses exposed to indoor uncontrolled air-EXT and dried air environments using the External Surface Monitoring Program.

The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review, the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F.

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.

The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21. 2008, the applicant explained, that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable

basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components and because this meets that staff's LRA screening basis in 10 CFR 54.21(a)(1)(ii) that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, "wear" is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that as such, loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluated the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant's basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking. The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of "change in material properties." The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, volume 2), Section IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms," the staff groups "weathering" as an aging mechanism within the scope of the grouping "Elastomer degradation," and defines "weathering" as "Degradation of external surfaces of materials when exposed to outside environment." The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, do not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant's UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicants response and finds that, chemical degradation of elastomer components in contact a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated

“short-lived.” On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), “short-lived” components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect “wear” is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant’s review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant’s response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of elastomeric flexible ventilation connection components exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant’s External Surfaces Monitoring Program is GALL AMP XI.M36, “External Surfaces Monitoring.” The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, “External Surfaces Monitoring,” is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, “External Surfaces Monitoring,” does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, “External Surfaces Monitoring,” does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant’s program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing cracking. The applicant’s program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in: (1) the elastomeric auxiliary system components that are exposed, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed externally to uncontrolled indoor air.

In its response dated July 21, 2008, the applicant explained that, as identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as “short-lived” and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the replacement activities will be determined based upon manufacturer recommendations and operating experience, and that the flexible hoses (non-flexible ventilation connection components) in the auxiliary feedwater system are, therefore, classified as short-lived and excluded from aging management review. The staff’s basis for concluding that the elastomeric components that are not elastomeric flexible connections in the plant’s ventilation systems do not need be subject to an AMR or to any AMPs for aging management has been discussed previously in this evaluation and that the applicant has justified amending the application to remove the AMR items for these components based on placing the components into a periodic maintenance and replacement program.

In regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, “External Surfaces Monitoring. The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers in noticed (such as a change in strength or hardness of the material).

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, the based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surfaces Monitoring Program. The External Surfaces Monitoring Program will be representative of the conditions on the internal

surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials.
The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant's letter of July 21, 2008. Based on the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9.The staff's concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

In LRA Table 3.3.2-12, the applicant states that polymeric flexible hoses exposed to condensation and indoor uncontrolled air-EXT experience no aging effect requiring management, and therefore does not require an aging management program.

The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

The staff reviewed the applicant's AMRs for the component-polymer-environment combinations listed in Table 3.3.2.3-3 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for the polymer auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water. The component-polymer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI 3.3.2.3-4 to request identification of the specific polymer materials that were used in fabrication of the components listed in these auxiliary system AMR items and to provide a more detailed technical basis on whether there are any AERMs for the component-polymer material-environment combinations in these AMRs.

In its letter dated July 21, 2008, the applicant explained that it has reviewed details associated with the various polymer components addressed in the LRA. The applicant stated that Polymer hoses in the Halon fire protection subsystems are periodically tested and replaced on condition, and, therefore, are considered consumables as described in LRA Section 2.1.2.4.3.

The applicant stated that the BVPS LRA is revised to include a new License Renewal Future Commitment to address the remaining polymer components. The applicant explained that specifically, with the exception noted in this response, it will perform repetitive maintenance tasks prior to the period of extended operation, to periodically replace, or to periodically test and replace on condition, polymer components identified in LRA Sections 3.1, 3.2, 3.3 and 3.4 such that those components are classified as "short-lived" and not subject to aging management, per 10 CFR 54.21 (a)(1)(ii). The applicant identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience.

The applicant stated that the exception to testing/replacement of polymers by preventive maintenance is GeoFlex®-D piping used as the buried fuel oil piping in the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems.

The applicant stated that the LRA is further revised to delete, as appropriate, the polymer component types, materials and aging effects from the LRA Table 2s and the summary lists of materials and environments in LRA Sections 3.1, 3.2, 3.3 and 3.4. The applicant referred to the Enclosure to this letter for the revision to the BVPS LRA.

In response to the first part of this RAI, which asks the identity of the polymeric material from which the polymer subject to AMR is manufactured, the applicant states that the GeoFlex®-D piping is a double-walled, flexible piping system designed for direct burial and that GeoFlex® pipe is a totally-bonded, multi-layer composite construction with braided fiber reinforcement. The applicant further explained that the inner-most Kynar® (polyvinylidene fluoride) barrier layer is impermeable to diesel fuel and that the exterior has a nylon barrier layer to protect the outer wall from chemical and microbial attack. The applicant also stated that additional intermediate layers are made of polyethylene and nylon.

In response to the second part of this RAI, which asks whether the polymer is elastomeric, thermoplastic, or thermoset material in order to identify their age-related degradation mechanisms, the applicant stated that Kynar®, nylon and polyethylene are thermoplastics. The applicant further stated that it used the EPRI Mechanical Tools to determine that polymers, such as those used in GeoFlex® piping, are either completely resistant to the fluid environment, or they deteriorate. Further the applicant stated that unlike metals, plastics do not display corrosion rates. The applicant explained that rather than depending upon an oxide layer for protection, plastics depend upon chemical resistance to the environment to which they are exposed. The applicant further explained that acceptability for the use of plastics within a given environment is a design-driven criterion; once the appropriate material is chosen, the system will have no aging effects due to exposure to the contained fluid however, chemical decomposition due to exposure to ozone and ultraviolet or ionizing radiation is a potential aging effect for some polymers.

In response to the third part of this RAI, which asks about the particular environment to which each polymer subject to AMR is exposed and its AERMs, the applicant stated that the materials of construction of GeoFlex® piping were specifically chosen for use in transporting fuel oils and for direct burial. The applicant identified that the product is Underwriters Laboratories (UL) listed for this application. Further, the applicant stated that the soil environment precludes exposure to ozone and to ultraviolet and ionizing radiation. The applicant referenced an April 22, 1997, U.S. Environmental Protection Agency Memo (from Anna Hopkins Virbick, Director, Office of Underground Storage Tanks, to Environmental Protection Agency UST/LUST Regional Program Managers and State UST Program Managers - Subject: Transmittal of Survey of Flexible Piping Systems) transmitted the results of a survey of flexible piping used in underground fuel oil delivery systems, and included evaluation of GeoFlex® operating experience. The applicant stated that the survey concluded that problems with the systems have been infrequent, and the performance of the technology has been excellent.

The applicant concluded that based on this review of industry operating experience and the use of proper design and application of the material, GeoFlex® piping materials with internal fuel oil and external buried (soil) environments do not exhibit aging effects requiring management.

The staff reviewed the applicant's response to RAI 3.3.2.3-4 and its revised LRA which includes a new License Renewal Future Commitment to address the polymer components subject to AMR, and finds that it adequately explains that with the exception of the underground fuel oil piping servicing the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems, all the polymeric material previously described in the LRA Table 2's are now designated as short-lived. The staff further evaluated the applicant's explanation that the short-lived polymeric components will be subject to periodic testing and replacement activities based on manufacturer's recommendations and operating experience. The staff also evaluated the applicant's response concerning Halon system fire hoses and finds that they are consumable items under LRA Section 2.1.2.4.3.

The staff reviewed the applicant's explanation of the fuel oil piping to the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems which it identified as GeoFlex® D. The staff finds that this material is a polymer similar to polymers used in other nuclear plant applications such as fiberglass and PVC and therefore, will not result in aging that will be of concern during the period of extended operation and that because the piping was designed for direct burial, there are no AERMs requiring management. Therefore, the staff's concern in RAI 3.3.2.3-4 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.13 Emergency Diesel Generators - Crankcase Vacuum System - Summary of Aging Management Evaluation – LRA Table 3.3.2-13

The staff reviewed LRA Table 3.3.2-13, which summarizes the results of AMR evaluations for the emergency diesel generators - crankcase vacuum system component groups.

In LRA Table 3.3.2-13, the applicant proposed to manage cracking of the elastomeric flexible hose exposed to indoor uncontrolled air-EXT using the External Surface Monitoring Program.

Assessment of Applicable Aging Effects. The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F.

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.

The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21, 2008, the applicant explained, that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components and because this meets that staff's LRA screening basis in 10 CFR 54.21(a)(1)(ii) that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, "wear" is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that as such, loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluated the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant's basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking. The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of "change in material properties." The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, volume 2), Section IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms," the staff groups "weathering" as an aging mechanism within the scope of the grouping "Elastomer degradation," and defines "weathering" as "Degradation of external surfaces of materials when exposed to outside environment." The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, do not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant's UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicants response and finds that, chemical degradation of elastomer components in contact a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated "short-lived." On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), "short-lived" components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect "wear" is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant's review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant's response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

Assessment of the Applicant's Aging Management Programs or Activities Credited for Aging Management. The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of flexible connection exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant's External Surfaces Monitoring Program is GALL AMP XI.M36, "External Surfaces Monitoring." The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, "External Surfaces Monitoring," is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, "External Surfaces Monitoring," does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, "External Surfaces Monitoring," does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant's program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing cracking. The applicant's program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in: (1) the elastomeric auxiliary system components that are exposed, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed externally to uncontrolled indoor air.

In its response dated July 21, 2008, the applicant explained that, as identified in the response to RAI-3.3.2.3-3 / 3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the replacement activities will be determined based upon manufacturer recommendations and operating experience, and that the

flexible hoses (non-flexible ventilation connection components) in the auxiliary feedwater system are, therefore, classified as short-lived and excluded from aging management review.
The staff's basis for concluding that the non-flexible ventilation connection components in the auxiliary systems do not need be subject to an AMR or to any AMPs for aging management has been discussed previously in the *Assessment of Applicable Aging Effects* portion of this evaluation

In regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, "External Surfaces Monitoring. The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers in noticed (such as a change in strength or hardness of the material)

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, the based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surface Monitoring Program . The External Surfaces Monitoring Program will be representative of the conditions on the internal surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual

examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials.
The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant's letter of July 21, 2008. Based on the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

Conclusion. On the basis of its review the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-13, the applicant states that elastomeric flexible hose exposed to lubricating oil experiences no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

The staff reviewed the applicant's AMRs for the component-elastomer-environment combinations listed in Table 3.3.2.3-2 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for: (1) the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed to either lubricating oil or externally to an borated water leakage environment. The component-elastomer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI 3.3.2.3-3/3.4.2.3-3 to request identification of the specific elastomeric materials that were used in fabrication of the elastomeric components listed in these auxiliary AMR items (and for the flexible hoses in the auxiliary feedwater systems) and to provide a more detailed technical basis on whether there are any AERMs for the component-elastomer material-environment combinations in these AMRs.

The applicant responded to RAI 3.3.2.3-3/3.4.2.3-3 in a letter dated July 21, 2008. In its response, the applicant stated that BVPS LRA is revised to include a new License Renewal Future Commitment to address elastomeric components. The applicant clarified that with the exception of elastomeric flexible ventilation connection components in the control area and plant are ventilation systems, the applicant will perform repetitive maintenance tasks and periodic replacement of the elastomeric components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 prior to the period of extended operation, such that the components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii). The applicant also identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience. The staff noted that replacing these elastomeric components on a frequency that is consistent with the vendor recommendations provides an acceptable basis for replacing these components on a specified qualified life. The staff verified that, in the applicant's letter of July 21, 2008, the applicant appropriate amended the LRA to delete the AMRs for these components from the scope of the LRA and to instead amend the application to incorporate these components into a periodic replacement program under LRA Commitment No. 21 in UFSAR Supplement Table A.4-1 for Unit and Commitment No. 23 in UFSAR Supplement Table A.5-1 for Unit 2. Thus, based on this review, the staff finds this to be an acceptable basis for not including these elastomeric components within the scope of an AMR because the components will be replaced on a specified qualified life for the components such that the components are not required to be subject to an aging management review in accordance with the requirements of 10 CFR 54.21(a)(1)(i) and (ii).

For the elastomeric flexible connection components in the control area and plant area ventilation systems (i.e. flexible ventilation connection components) the applicant explained that the components will remain categorized as "long-lived" and will remain subject to aging management review. For these components, with respect to the applicant's response to RAI 3.3.2.3-3/3.4.2.3-3, Part 1, the applicant clarified that the elastomeric flexible ventilation connection components are fabricated of fiberglass, with double coated with neoprene (polychloroprene) on the internal and external fiberglass surfaces. The staff reviewed the applicant's response to 3.3.2.3-3/3.4.2.3-3, Part 1, and finds that it adequately resolved the question raised in the RAI because the response clearly identified the elastomeric material that was used in the fabrication of the elastomeric components mentioned in these plant-specific AMR items. RAI 3.3.2.3-3/3.4.2.3-3, Part 1, is resolved.

In its response to RAI 3.3.2.3-3/3.4.2.3-3, Parts 2 and 3, the applicant stated that according to the EPRI Structural Tools, Section 7.1.1:

> "Neoprene is chemically and structurally similar to natural rubber, and its mechanical properties are also similar. This resistance to oils, chemicals, sunlight, weathering, aging and ozone is outstanding. It retains its properties at temperatures up to 250°F."

The applicant further explained that the EPRI Structural Tools identifies various changes in elastomer properties that corresponded to the aging effects identified as "cracking" and as "hardening and loss of strength" in the GALL Report, and that the environmental conditions that might result in these aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant clarified that neoprene is relatively insensitive to temperature, ozone, and ultraviolet and ionizing radiation exposure, but the potential for the GALL Report aging effects of "cracking and "hardening and loss of strength" was not excluded for neoprene aging evaluations. The applicant explained that it assigned both "Air-indoor uncontrolled" and "Air with borated water leakage" environments to in-scope components in areas containing borated water systems. Where the external environment of "Air with borated water leakage' exists, the environment of "Air-indoor uncontrolled" is also evaluated. However, the applicant clarified that the presence of boric acid leakage does not result in additional aging effects for elastomers in general or neoprene specifically, and that as a result of these determination, no additional aging effects were identified for the neoprene surfaces that are associated specifically with an air with borated water leakage environment.

The staff noted that the aging effects identified by the applicant for these elastomeric flexible ventilation connection components were consistent with the aging effects for elastomeric components listed in Section VII of the GALL Report, Volume 2. Based on this review, the staff finds that it adequately resolved the staff's inquiry on the aging effects that are applicable to these elastomeric components because the applicant has identified cracking and changes in the hardness or strength properties are the aging effects requiring management for the surfaces that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water and because the staff has verified that this is in conformance with the applicable aging effects that are listed for elastomeric components in the AMRs of Section VII of the GALL Report, Volume 2.

The staff noted that for the elastomeric flexible ventilation connection components in the BVPS control area and plant area ventilation systems, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in hardness or strength of the elastomeric flexible ventilation connection components. The staff also noted, that in the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2, dated July 21, 2008, the applicant clarified that the visual examinations of these flexible ventilation connection components would be supplemented by physical manipulations of the components in order to aid with the identification of cracking or any changes in the hardness or strength properties of the components.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests of these elastomeric components in the applicant's letter of July 21, 2008. Based on the applicant's response to RAIs 3.3.2.3-2/3.4.2.3-2 and 3.3.2.3-3/3.4.2.3-3 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concerns and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing cracking in the components or any significant changes in the hardness or strength properties of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concerns in RAI 3.3.2.3-2/3.4.2.3-2 and RAI 3.3.2.3-3/3.4.2.3-3 are resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.14 Emergency Diesel Generators - Fuel Oil System - Summary of Aging Management Evaluation – LRA Table 3.3.2-14

The staff reviewed LRA Table 3.3.2-14, which summarizes the results of AMR evaluations for the emergency diesel generators - fuel oil system component groups.

In LRA Table 3.3.2-14, the applicant proposed to manage loss of material of stainless steel bolting exposed to air-outdoor – external environment using the Bolting Integrity Program. For these components the applicant cites Note G, which indicates that environment is not in the GALL Report for this component and material. However, in other Tables such as Table 3.2.2-1, lines 63, 71, 126, etc., the LRA has identified aging effects as "none" for the same material/environment combination. The staff issued RAI 3.3-2.14-1 to request the applicant to justify why an aging effect is identified in this case and not in others.

In its letter dated July 24, 2008, the applicant stated that both carbon steel and stainless steel bolting were assumed to exist in the portions of the diesel generator fuel oil subsystem that are outside and potentially susceptible to pooling. However, further applicant evaluation in response to this question concluded that there is no stainless steel bolting in an air-outdoor environment in the diesel generator fuel oil subsystem. The applicant revised the LRA to delete this line item.

On the basis that this line item is deleted, the staff finds the response acceptable.

The staff reviewed LRA Table 3.3.2-14, which summarizes the results of AMRs for the Emergency Diesel Generators-Fuel Oil System component groups.

In LRA Table 3.3.2-14 the applicant proposed to manage cracking of copper alloy >15% Zn piping and valve bodies exposed to fuel oil using the Fuel Oil Chemistry and One-Time Inspection Programs. During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results line that references Note H and determined that the aging effect for the component type, material, and environment are not within the GALL Report.

The staff noted that the applicant's proposed programs would be effective in preventing, monitoring, and detecting this aging effect because the Fuel Oil Chemistry Program mitigates conditions conducive to cracking by ensuring that fuel oil chemistry parameters are kept within those specified by ASTM Standards. Further, the One-Time Inspection Program verifies the effectiveness of the Fuel Oil Chemistry Program by inspecting for the occurrences of the aging effects. The staff's evaluation of the Fuel Oil Chemistry Program is documented in SER Section 3.0.3.2.8. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this aging effect is appropriate and will be adequately managed by Fuel Oil Chemistry Program and the One-Time Inspection Program.

In LRA Table 3.3.2-14, the applicant proposed to manage cracking of the elastomeric flexible hoses exposed to indoor uncontrolled air-EXT environment using the External Surface Monitoring Program.

Assessment of Applicable Aging Effects. The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F.

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.

The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21. 2008, the applicant explained, that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to RAI-3.3.2.3-3 / 3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components and because this meets that staff's LRA screening basis in 10 CFR 54.21(a)(1)(ii) that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, "wear" is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that as such, loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluated the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant's basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking. The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of "change in material properties." The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, volume 2), Section IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms," the staff groups "weathering" as an aging mechanism within the scope of the grouping "Elastomer degradation," and defines "weathering" as "Degradation of external surfaces of materials when exposed to outside environment." The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, do not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant's UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicants response and finds that, chemical degradation of elastomer components in contact with a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated "short-lived." On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), "short-lived" components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect "wear" is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant's review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant's response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

Assessment of the Applicant's Aging Management Programs or Activities Credited for Aging Management. The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of flexible connection exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant's External Surfaces Monitoring Program is GALL AMP XI.M36, "External Surfaces Monitoring." The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, "External Surfaces Monitoring," is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, "External Surfaces Monitoring," does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, "External Surfaces Monitoring," does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant's program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing cracking. The applicant's program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in: (1) the elastomeric auxiliary system components that are exposed, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed externally to uncontrolled indoor air.

In its response dated July 21, 2008, the applicant explained that, as identified in the response to RAI-3.3.2.3-3 / 3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as “short-lived” and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the replacement activities will be determined based upon manufacturer recommendations and operating experience, and that the flexible hoses (non-flexible ventilation connection components) in the auxiliary feedwater system are, therefore, classified as short-lived and excluded from aging management review. The staff’s basis for concluding that the non-flexible ventilation connection components in the auxiliary systems do not need be subject to an AMR or to any AMPs for aging management has been discussed previously in the *Assessment of Applicable Aging Effects* portion of this evaluation.

In regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, “External Surfaces Monitoring. The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers in noticed (such as a change in strength or hardness of the material)

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, the based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surfaces Monitoring Program. The External Surfaces Monitoring Program will be representative of the conditions on the internal surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant's letter of July 21, 2008. Based on the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-14, the applicant states that elastomeric flexible hose exposed to fuel oil experiences no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

The staff reviewed the applicant's AMRs for the component-elastomer-environment combinations listed in Table 3.3.2.3-2 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for: (1) the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed to either lubricating oil or externally to an borated water leakage environment. The component-elastomer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI 3.3.2.3-3/3.4.2.3-3 to request identification of the specific elastomeric materials that were used in fabrication of the elastomeric components listed in these auxiliary AMR items (and for the flexible hoses in the auxiliary feedwater systems) and to provide a more detailed technical basis on whether there are any AERMs for the component-elastomer material-environment combinations in these AMRs.

The applicant responded to RAI 3.3.2.3-3/3.4.2.3-3 in a letter dated July 21, 2008. In its response, the applicant stated that BVPS LRA is revised to include a new License Renewal Future Commitment to address elastomeric components. The applicant clarified that with the exception of elastomeric flexible ventilation connection components in the control area and plant are ventilation systems, the applicant will perform repetitive maintenance tasks and periodic replacement of the elastomeric components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 prior to the period of extended operation, such that the components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii). The applicant also identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience. The staff noted that replacing these elastomeric components on a frequency that is consistent with the vendor recommendations provides an acceptable basis for replacing these components on a specified qualified life. The staff verified that, in the applicant's letter of July 21, 2008, the applicant appropriate amended the LRA to delete the AMRs for these components from the scope of the LRA and to instead amend the application to incorporate these components into a periodic replacement program under LRA Commitment No. 21 in UFSAR Supplement Table A.4-1 for Unit and Commitment No. 23 in UFSAR Supplement Table A.5-1 for Unit 2. Thus, based on this review, the staff finds this to be an acceptable basis for not including these elastomeric components within the scope of an AMR because the components will be replaced on a specified qualified life for the components such that the components are not required to be subject to an aging management review in accordance with the requirements of 10 CFR 54.21(a)(1)(i) and (ii).

For the elastomeric flexible connection components in the control area and plant area ventilation systems (i.e. flexible ventilation connection components) the applicant explained that the components will remain categorized as "long-lived" and will remain subject to aging management review. For these components, with respect to the applicant's response to RAI 3.3.2.3-3/3.4.2.3-3, Part 1, the applicant clarified that the elastomeric flexible ventilation connection components are fabricated of fiberglass, with double coated with neoprene (polychloroprene) on the internal and external fiberglass surfaces. The staff reviewed the applicant's response to 3.3.2.3-3/3.4.2.3-3, Part 1, and finds that it adequately resolved the question raised in the RAI because the response clearly identified the elastomeric material that was used in the fabrication of the elastomeric components mentioned in these plant-specific AMR items. RAI 3.3.2.3-3/3.4.2.3-3, Part 1, is resolved.

In its response to RAI 3.3.2.3-3/3.4.2.3-3, Parts 2 and 3, the applicant stated that according to the EPRI Structural Tools, Section 7.1.1:

> "Neoprene is chemically and structurally similar to natural rubber, and its mechanical properties are also similar. This resistance to oils, chemicals, sunlight, weathering, aging and ozone is outstanding. It retains its properties at temperatures up to 250°F."

The applicant further explained that the EPRI Structural Tools identifies various changes in elastomer properties that corresponded to the aging effects identified as "cracking" and as "hardening and loss of strength" in the GALL Report, and that the environmental conditions that might result in these aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant clarified that neoprene is relatively insensitive to temperature, ozone, and ultraviolet and ionizing radiation exposure, but the potential for the GALL Report aging effects of "cracking and "hardening and loss of strength" was not excluded for neoprene aging evaluations. The applicant explained that it assigned both "Air-indoor uncontrolled" and "Air with borated water leakage" environments to in-scope components in areas containing borated water systems. Where the external environment of "Air with borated water leakage' exists, the environment of "Air-indoor uncontrolled" is also evaluated. However, the applicant clarified that the presence of boric acid leakage does not result in additional aging effects for elastomers in general or neoprene specifically, and that as a result of these determination, no additional aging effects were identified for the neoprene surfaces that are associated specifically with an air with borated water leakage environment.

The staff noted that the aging effects identified by the applicant for these elastomeric flexible ventilation connection components were consistent with the aging effects for elastomeric components listed in Section VII of the GALL Report, Volume 2. Based on this review, the staff finds that it adequately resolved the staff's inquiry on the aging effects that are applicable to these elastomeric components because the applicant has identified cracking and changes in the hardness or strength properties are the aging effects requiring management for the surfaces that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water and because the staff has verified that this is in conformance with the applicable aging effects that are listed for elastomeric components in the AMRs of Section VII of the GALL Report, Volume 2.

The staff noted that for the elastomeric flexible ventilation connection components in the BVPS control area and plant area ventilation systems, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in hardness or strength of the elastomeric flexible ventilation connection components. The staff also noted, that in the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2, dated July 21, 2008, the applicant clarified that the visual examinations of these flexible ventilation connection components would be supplemented by physical manipulations of the components in order to aid with the identification of cracking or any changes in the hardness or strength properties of the components.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests of these elastomeric components in the applicant's letter of July 21, 2008. Based on the applicant's response to RAIs 3.3.2.3-2/3.4.2.3-2 and 3.3.2.3-3/3.4.2.3-3 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concerns and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing cracking in the components or any significant changes in the hardness or strength properties of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concerns in RAI 3.3.2.3-2/3.4.2.3-2 and RAI 3.3.2.3-3/3.4.2.3-3 are resolved.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA table 3.3.2-14, the applicant proposed that piping composed of exposed to soil-EXT would have no aging effect requiring management and, there would be no aging management program. The combination of glass and closed cycle cooling water is not a material/environment combination covered in GALL. However, there are similar material/environment combinations covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.15 Emergency Diesel Generators - Lube Oil System - Summary of Aging Management Evaluation – LRA Table 3.3.2-15

The staff reviewed LRA Table 3.3.2-15, which summarizes the results of AMR evaluations for the emergency diesel generators - lube oil system component groups.

In LRA Table 3.3.2-15, the applicant proposed to manage loss of material in aluminum strainer bodies exposed to lubricating oil using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note G to these items. The staff reviewed the AMR results lines that reference Note G. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Lubricating oil is not an environment covered in the GALL Report for loss of material of aluminum strainer bodies. However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing, removing impurities conducive to loss of material. Additionally, any evidence of loss of material would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-15, the applicant proposed to manage loss of material in aluminum heat exchanger (fin) exposed to lubricating oil – EXT using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note G to these items. The staff reviewed the AMR results lines that reference Note G. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Lubricating oil – EXT is not an environment covered in the GALL Report for aluminum heat exchanger (fin) or other heat transfer surfaces for which loss of material is identified as its aging effect. However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing. Additionally, any evidence of loss of material would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-15, the applicant proposed to manage reduction of heat transfer in aluminum heat exchanger (fin) exposed to lubricating oil – EXT using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note G to these items. The staff reviewed the AMR results lines that reference Note G. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Lubricating oil – EXT is not an environment covered in the GALL Report for aluminum heat exchanger (fin) or other heat transfer surfaces for which reduction of heat transfer is identified as its aging effect. However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-15, the applicant proposed to manage reduction of heat transfer in copper alloy >15% Zn heat exchanger (tube) and heat exchanger (tube/core and tubesheet) exposed to lubricating oil – EXT using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Reduction of heat transfer is not an aging effect covered in the GALL Report for copper alloy >15% Zn heat exchanger (tube) and heat exchanger (tube/core and tubesheet) heat exchanger tubes or other heat transfer surfaces exposed to lubricating oil. However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-15, the applicant proposed to manage cracking of the elastomeric flexible hose exposed to indoor uncontrolled air-EXT environment using the External Surface Monitoring Program.

Assessment of Applicable Aging Effects. The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.

The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21, 2008, the applicant explained, that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components and because this meets the staff's LRA screening basis in 10 CFR 54.21(a)(1)(ii) that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, "wear" is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that as such, loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluated the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant's basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking.

The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of "change in material properties." The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, volume 2), Section IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms," the staff groups "weathering" as an aging mechanism within the scope of the grouping "Elastomer degradation," and defines "weathering" as "Degradation of external surfaces of materials when exposed to outside environment." The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, do not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant's UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicants response and finds that, chemical degradation of elastomer components in contact with a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated "short-lived." On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), "short-lived" components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect "wear" is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant's review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant's response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

Assessment of the Applicant's Aging Management Programs or Activities Credited for Aging Management**.** The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of flexible connection exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant's External Surfaces Monitoring Program is GALL AMP XI.M36, "External Surfaces Monitoring." The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, "External Surfaces Monitoring," is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, "External Surfaces Monitoring," does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, "External Surfaces Monitoring," does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant's program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing cracking. The applicant's program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in: (1) the elastomeric auxiliary system components that are exposed, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed externally to uncontrolled indoor air.

In its response dated July 21, 2008, the applicant explained that, as identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the replacement activities will be determined based upon manufacturer recommendations and operating experience, and that the flexible hoses (non-flexible ventilation connection components) in the auxiliary feedwater system are, therefore, classified as short-lived and excluded from aging management review. The staff's basis for concluding that the non-flexible ventilation connection components in the auxiliary systems do not need be subject to an AMR or to any AMPs for aging management has been discussed previously in the *Assessment of Applicable Aging Effects* portion of this evaluation.

In regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, "External Surfaces Monitoring. The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers in noticed (such as a change in strength or hardness of the material).

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, the based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surfaces Monitoring Program . The External Surfaces Monitoring Program will be representative of the conditions on the internal surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant’s letter of July 21, 2008. Based on the applicant’s response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant’s augmentation of its External Surfaces Monitoring Program, the staff concludes that the applicant has resolved the staff’s concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff’s concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

Conclusion. On the basis of its review the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-15, the applicant states that elastomeric flexible hose exposed to lubricating oil experiences no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

The staff reviewed the applicant's AMRs for the component-elastomer-environment combinations listed in Table 3.3.2.3-2 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for: (1) the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed to either lubricating oil or externally to an borated water leakage environment. The component-elastomer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI 3.3.2.3-3/3.4.2.3-3 to request identification of the specific elastomeric materials that were used in fabrication of the elastomeric components listed in these auxiliary AMR items (and for the flexible hoses in the auxiliary feedwater systems) and to provide a more detailed technical basis on whether there are any AERMs for the component-elastomer material-environment combinations in these AMRs.

The applicant responded to RAI 3.3.2.3-3/3.4.2.3-3 in a letter dated July 21, 2008. In its response, the applicant stated that BVPS LRA is revised to include a new License Renewal Future Commitment to address elastomeric components. The applicant clarified that with the exception of elastomeric flexible ventilation connection components in the control area and plant are ventilation systems, the applicant will perform repetitive maintenance tasks and periodic replacement of the elastomeric components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 prior to the period of extended operation, such that the components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii). The applicant also identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience. The staff noted that replacing these elastomeric components on a frequency that is consistent with the vendor recommendations provides an acceptable basis for replacing these components on a specified qualified life. The staff verified that, in the applicant's letter of July 21, 2008, the applicant appropriately amended the LRA to delete the AMRs for these components from the scope of the LRA and to instead amend the application to incorporate these components into a periodic replacement program under LRA Commitment No. 21 in UFSAR Supplement Table A.4-1 for Unit and Commitment No. 23 in UFSAR Supplement Table A.5-1 for Unit 2. Thus, based on this review, the staff finds this to be an acceptable basis for not including these elastomeric components within the scope of an AMR because the components will be replaced on a specified qualified life for the components such that the components are not required to be subject to an aging management review in accordance with the requirements of 10 CFR 54.21(a)(1)(i) and (ii).

For the elastomeric flexible connection components in the control area and plant area ventilation systems (i.e. flexible ventilation connection components) the applicant explained that the components will remain categorized as "long-lived" and will remain subject to aging management review. For these components, with respect to the applicant's response to RAI 3.3.2.3-3/3.4.2.3-3, Part 1, the applicant clarified that the elastomeric flexible ventilation connection components are fabricated of fiberglass, with double coated with neoprene (polychloroprene) on the internal and external fiberglass surfaces. The staff reviewed the applicant's response to 3.3.2.3-3/3.4.2.3-3, Part 1, and finds that it adequately resolved the question raised in the RAI because the response clearly identified the elastomeric material that was used in the fabrication of the elastomeric components mentioned in these plant-specific AMR items. RAI 3.3.2.3-3/3.4.2.3-3, Part 1, is resolved.

In its response to RAI 3.3.2.3-3/3.4.2.3-3,, Parts 2 and 3, the applicant stated that according to the EPRI Structural Tools, Section 7.1.1:

> "Neoprene is chemically and structurally similar to natural rubber, and its mechanical properties are also similar. This resistance to oils, chemicals, sunlight, weathering, aging and ozone is outstanding. It retains its properties at temperatures up to 250°F."

The applicant further explained that the EPRI Structural Tools identifies various changes in elastomer properties that corresponded to the aging effects identified as "cracking" and as "hardening and loss of strength" in the GALL Report, and that the environmental conditions that might result in these aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant clarified that neoprene is relatively insensitive to temperature, ozone, and ultraviolet and ionizing radiation exposure, but the potential for the GALL Report aging effects of "cracking and "hardening and loss of strength" was not excluded for neoprene aging evaluations. The applicant explained that it assigned both "Air-indoor uncontrolled" and "Air with borated water leakage" environments to in-scope components in areas containing borated water systems. Where the external environment of "Air with borated water leakage' exists, the environment of "Air-indoor uncontrolled" is also evaluated. However, the applicant clarified that the presence of boric acid leakage does not result in additional aging effects for elastomers in general or neoprene specifically, and that as a result of these determination, no additional aging effects were identified for the neoprene surfaces that are associated specifically with an air with borated water leakage environment.

The staff noted that the aging effects identified by the applicant for these elastomeric flexible ventilation connection components were consistent with the aging effects for elastomeric components listed in Section VII of the GALL Report, Volume 2. Based on this review, the staff finds that it adequately resolved the staff's inquiry on the aging effects that are applicable to these elastomeric components because the applicant has identified cracking and changes in the hardness or strength properties are the aging effects requiring management for the surfaces that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water and because the staff has verified that this is in conformance with the applicable aging effects that are listed for elastomeric components in the AMRs of Section VII of the GALL Report, Volume 2.

The staff noted that for the elastomeric flexible ventilation connection components in the BVPS control area and plant area ventilation systems, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in hardness or strength of the elastomeric flexible ventilation connection components. The staff also noted, that in the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2, dated July 21, 2008, the applicant clarified that the visual examinations of these flexible ventilation connection components would be supplemented by physical manipulations of the components in order to aid with the identification of cracking or any changes in the hardness or strength properties of the components.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests of these elastomeric components in the applicant's letter of July 21, 2008. Based on the applicant's response to RAIs 3.3.2.3-2/3.4.2.3-2 and 3.3.2.3-3/3.4.2.3-3 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concerns and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing cracking in the components or any significant changes in the hardness or strength properties of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concerns in RAI 3.3.2.3-2/3.4.2.3-2 and RAI 3.3.2.3-3/3.4.2.3-3 are resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.16 Emergency Diesel Generators - Water Cooling System - Summary of Aging Management Evaluation – LRA Table 3.3.2-16

The staff reviewed LRA Table 3.3.2-16, which summarizes the results of AMR evaluations for the emergency diesel generators - water cooling system component groups.

In LRA Table 3.3.2-16, the applicant proposed to manage reduction of heat transfer in copper alloy >15% Zn heat exchanger (tube) exposed to lubricating oil – EXT using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Reduction of heat transfer is not an aging effect covered in the GALL Report for copper alloy >15% Zn heat exchanger (tube) heat exchanger tubes or other heat transfer surfaces exposed to lubricating oil. However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-16, the applicant proposed to manage cracking of the elastomeric flexible hose exposed to indoor uncontrolled air-EXT environment using the External Surface Monitoring Program.

Assessment of Applicable Aging Effects. The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.

The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21, 2008, the applicant explained, that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable

basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components and because this meets that staff's LRA screening basis in 10 CFR 54.21(a)(1)(ii) that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, "wear" is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that as such, loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluated the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant's basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking. The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of "change in material properties." The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, volume 2), Section IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms," the staff groups "weathering" as an aging mechanism within the scope of the grouping "Elastomer degradation," and defines "weathering" as "Degradation of external surfaces of materials when exposed to outside environment." The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, do not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant's UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicants response and finds that, chemical degradation of elastomer components in contact with a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated

“short-lived.” On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), “short-lived” components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect “wear” is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant’s review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant’s response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

Assessment of the Applicant’s Aging Management Programs or Activities Credited for Aging Management. The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of flexible connection exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant’s External Surfaces Monitoring Program is GALL AMP XI.M36, “External Surfaces Monitoring.” The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, “External Surfaces Monitoring,” is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, “External Surfaces Monitoring,” does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, “External Surfaces Monitoring,” does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant’s program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing cracking. The applicant’s program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in: (1) the elastomeric auxiliary system components that are exposed, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed externally to uncontrolled indoor air.

In its response dated July 21, 2008, the applicant explained that, as identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the replacement activities will be determined based upon manufacturer recommendations and operating experience, and that the flexible hoses (non-flexible ventilation connection components) in the auxiliary feedwater system are, therefore, classified as short-lived and excluded from aging management review. The staff's basis for concluding that the non-flexible ventilation connection components in the auxiliary systems do not need to be subject to an AMR or to any AMPs for aging management has been discussed previously in the *Assessment of Applicable Aging Effects* portion of this evaluation.

In regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, "External Surfaces Monitoring.
The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers in noticed (such as a change in strength or hardness of the material).

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, the based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surfaces Monitoring Program . The External Surfaces Monitoring Program will be representative of the conditions on the internal

surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant's letter of July 21, 2008. Based on the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

<u>Conclusion</u>. On the basis of its review the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-16, the applicant states that elastomeric flexible hose exposed to closed cycle cooling water experiences no aging effect requiring management, and therefore does not require an aging management program.

<u>Staff Evaluation</u>

<u>*Assessment*</u>. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

The staff reviewed the applicant's AMRs for the component-elastomer-environment combinations listed in Table 3.3.2.3-2 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for: (1) the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed to either lubricating oil or externally to an borated water leakage environment. The component-elastomer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI 3.3.2.3-3/3.4.2.3-3 to request identification of the specific elastomeric materials that were used in fabrication of the elastomeric components listed in these auxiliary AMR items (and for the flexible hoses in the auxiliary feedwater systems) and to provide a more detailed technical basis on whether there are any AERMs for the component-elastomer material-environment combinations in these AMRs.

The applicant responded to RAI 3.3.2.3-3/3.4.2.3-3 in a letter dated July 21, 2008. In its response, the applicant stated that BVPS LRA is revised to include a new License Renewal Future Commitment to address elastomeric components. The applicant clarified that with the exception of elastomeric flexible ventilation connection components in the control area and plant are ventilation systems, the applicant will perform repetitive maintenance tasks and periodic replacement of the elastomeric components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 prior to the period of extended operation, such that the components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii). The applicant also identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience. The staff noted that replacing these elastomeric components on a frequency that is consistent with the vendor recommendations provides an acceptable basis for replacing these components on a specified qualified life. The staff verified that, in the applicant's letter of July 21, 2008, the applicant appropriately amended the LRA to delete the AMRs for these components from the scope of the LRA and to instead amend the application to incorporate these components into a periodic replacement program under LRA Commitment No. 21 in UFSAR Supplement Table A.4-1 for Unit and Commitment No. 23 in UFSAR Supplement Table A.5-1 for Unit 2. Thus, based on this review, the staff finds this to be an acceptable basis for not including these elastomeric components within the scope of an AMR because the components will be replaced on a specified qualified life for the components such that the components are not required to be subject to an aging management review in accordance with the requirements of 10 CFR 54.21(a)(1)(i) and (ii).

For the elastomeric flexible connection components in the control area and plant area ventilation systems (i.e. flexible ventilation connection components) the applicant explained that the components will remain categorized as “long-lived” and will remain subject to aging management review. For these components, with respect to the applicant's response to RAI 3.3.2.3-3/3.4.2.3-3, Part 1, the applicant clarified that the elastomeric flexible ventilation connection components are fabricated of fiberglass, with double coated with neoprene (polychloroprene) on the internal and external fiberglass surfaces. The staff reviewed the applicant's response to 3.3.2.3-3/3.4.2.3-3, Part 1, and finds that it adequately resolved the question raised in the RAI because the response clearly identified the elastomeric material that was used in the fabrication of the elastomeric components mentioned in these plant-specific AMR items. RAI 3.3.2.3-3/3.4.2.3-3, Part 1, is resolved.

In its response to RAI 3.3.2.3-3/3.4.2.3-3, Parts 2 and 3, the applicant stated that according to the EPRI Structural Tools, Section 7.1.1:

> "Neoprene is chemically and structurally similar to natural rubber, and its mechanical properties are also similar. This resistance to oils, chemicals, sunlight, weathering, aging and ozone is outstanding. It retains its properties at temperatures up to 250°F."

The applicant further explained that the EPRI Structural Tools identifies various changes in elastomer properties that corresponded to the aging effects identified as "cracking" and as "hardening and loss of strength" in the GALL Report, and that the environmental conditions that might result in these aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant clarified that neoprene is relatively insensitive to temperature, ozone, and ultraviolet and ionizing radiation exposure, but the potential for the GALL Report aging effects of "cracking and "hardening and loss of strength" was not excluded for neoprene aging evaluations. The applicant explained that it assigned both "Air-indoor uncontrolled" and "Air with borated water leakage" environments to in-scope components in areas containing borated water systems. Where the external environment of "Air with borated water leakage' exists, the environment of "Air-indoor uncontrolled" is also evaluated. However, the applicant clarified that the presence of boric acid leakage does not result in additional aging effects for elastomers in general or neoprene specifically, and that as a result of these determination, no additional aging effects were identified for the neoprene surfaces that are associated specifically with an air with borated water leakage environment.

The staff noted that the aging effects identified by the applicant for these elastomeric flexible ventilation connection components were consistent with the aging effects for elastomeric components listed in Section VII of the GALL Report, Volume 2. Based on this review, the staff finds that it adequately resolved the staff's inquiry on the aging effects that are applicable to these elastomeric components because the applicant has identified cracking and changes in the hardness or strength properties are the aging effects requiring management for the surfaces that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water and because the staff has verified that this is in conformance with the applicable aging effects that are listed for elastomeric components in the AMRs of Section VII of the GALL Report, Volume 2.

The staff noted that for the elastomeric flexible ventilation connection components in the BVPS control area and plant area ventilation systems, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in hardness or strength of the elastomeric flexible ventilation connection components. The staff also noted, that in the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2, dated July 21, 2008, the applicant clarified that the visual examinations of these flexible ventilation connection components would be supplemented by physical manipulations of the components in order to aid with the identification of cracking or any changes in the hardness or strength properties of the components.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed

or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests of these elastomeric components in the applicant's letter of July 21, 2008. Based on the applicant's response to RAIs 3.3.2.3-2/3.4.2.3-2 and 3.3.2.3-3/3.4.2.3-3 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concerns and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing cracking in the components or any significant changes in the hardness or strength properties of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concerns in RAI 3.3.2.3-2/3.4.2.3-2 and RAI 3.3.2.3-3/3.4.2.3-3 are resolved.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-16, the applicant states that (1) polymeric piping exposed to closed cycle cooling water and indoor uncontrolled air-EXT and (2) polymeric sight glasses exposed to indoor uncontrolled air/EXT and closed cycle cooling water experience no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

Assessment of the Applicant's Identification of Aging Effects. The staff reviewed the applicant's AMRs for the component-polymer-environment combinations listed in Table 3.3.2.3-3 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for the polymer auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water. The component-polymer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI # 3.3.2.3-4 to request identification of the specific polymer materials that were used in fabrication of the components listed in these auxiliary system AMR items and to provide a more detailed technical basis on whether there are any AERMs for the component-polymer material-environment combinations in these AMRs.

In its letter dated July 21, 2008, the applicant explained that it has reviewed details associated with the various polymer components addressed in the LRA. The applicant stated that Polymer hoses in the Halon fire protection subsystems are periodically tested and replaced on condition, and, therefore, are considered consumables as described in LRA Section 2.1.2.4.3.

The applicant stated that the BVPS LRA is revised to include a new License Renewal Future Commitment to address the remaining polymer components. The applicant explained that specifically, with the exception noted in this response, it will perform repetitive maintenance tasks prior to the period of extended operation, to periodically replace, or to periodically test and replace on condition, polymer components identified in LRA Sections 3.1, 3.2, 3.3 and 3.4 such that those components are classified as "short-lived" and not subject to aging management, per 10 CFR 54.21 (a)(1)(ii). The applicant identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience.

The applicant stated that the exception to testing/replacement of polymers by preventive maintenance is GeoFlex®-D piping used as the buried fuel oil piping in the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems.

The applicant stated that the LRA is further revised to delete, as appropriate, the polymer component types, materials and aging effects from the LRA Table 2's and the summary lists of materials and environments in LRA Sections 3.1, 3.2, 3.3 and 3.4. The applicant referred to the Enclosure to this letter for the revision to the BVPS LRA.

In response to the first part of this RAI, which asks the identity of the polymeric material from which the polymer subject to AMR is manufactured, the applicant states that the GeoFlex®-D piping is a double-walled, flexible piping system designed for direct burial and that GeoFlex® pipe is a totally-bonded, multi-layer composite construction with braided fiber reinforcement. The applicant further explained that the inner-most Kynar® (polyvinylidene fluoride) barrier layer is impermeable to diesel fuel and that the exterior has a nylon barrier layer to protect the outer wall from chemical and microbial attack. The applicant also stated that additional intermediate layers are made of polyethylene and nylon.

In response to the second part of this RAI, which asks whether the polymer is elastomeric, thermoplastic, or thermoset material in order to identify their age-related degradation mechanisms, the applicant stated that Kynar®, nylon and polyethylene are thermoplastics. The applicant further stated that it used the EPRI Mechanical Tools to determine that polymers, such as those used in GeoFlex® piping, are either completely resistant to the fluid environment, or they deteriorate. Further, the applicant stated that unlike metals, plastics do not display corrosion rates. The applicant explained that rather than depending upon an oxide layer for protection, plastics depend upon chemical resistance to the environment to which they are exposed. The applicant further explained that acceptability for the use of plastics within a given environment is a design-driven criterion; once the appropriate material is chosen, the system will have no aging effects due to exposure to the contained fluid however, chemical decomposition due to exposure to ozone and ultraviolet or ionizing radiation is a potential aging effect for some polymers.

In response to the third part of this RAI, which asks about the particular environment to which each polymer subject to AMR is exposed and its AERMs, the applicant stated that the materials of construction of GeoFlex® piping were specifically chosen for use in transporting fuel oils and for direct burial. The applicant identified that the product is Underwriters Laboratories (UL) listed for this application. Further, the applicant stated that the soil environment precludes exposure to ozone and to ultraviolet and ionizing radiation. The applicant referenced an April 22, 1997, U.S. Environmental Protection Agency Memo (from Anna Hopkins Virbick, Director, Office of Underground Storage Tanks, to Environmental Protection Agency UST/LUST Regional Program Managers and State UST Program Managers - Subject: Transmittal of Survey of Flexible Piping Systems) transmitted the results of a survey of flexible piping used in underground fuel oil delivery systems, and included evaluation of GeoFlex® operating experience. The applicant stated that the survey concluded that problems with the systems have been infrequent, and the performance of the technology has been excellent.

The applicant concluded that based on this review of industry operating experience and the use of proper design and application of the material, GeoFlex® piping materials with internal fuel oil and external buried (soil) environments do not exhibit aging effects requiring management.

The staff reviewed the applicant's response to RAI 3.3.2.3-4 and its revised LRA which includes a new License Renewal Future Commitment to address the polymer components subject to AMR, and finds that it adequately explains that with the exception of the underground fuel oil piping servicing the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems, all the polymeric material previously described in the LRA Table 2's are now designated as short-lived. The staff further evaluated the applicant's explanation that the short-lived polymeric components will be subject to periodic testing and replacement activities based on manufacturer's recommendations and operating experience. The staff also evaluated the applicant's response concerning Halon system fire hoses and finds that they are consumable items under LRA Section 2.1.2.4.3.

The staff reviewed the applicant's explanation of the fuel oil piping to the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems which it identified as GeoFlex® D. The staff finds that this material is a polymer similar to polymers used in other nuclear plant applications such as fiberglass and PVC and therefore, will not result in aging that will be of concern during the period of extended operation and that because the piping was designed for direct burial, there are no AERMs requiring management. Therefore, the staff's concern in RAI 3.3.2.3-4 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.17 Emergency Response Facility Substation System (Common) - Summary of Aging Management Evaluation – LRA Table 3.3.2-17

The staff reviewed LRA Table 3.3.2-17, which summarizes the results of AMR evaluations for the emergency response facility substation (common) component groups.

In LRA Table 3.3.2-17, the applicant proposed to manage cumulative fatigue damage of steel piping, exhaust silencer and turbocharger housing exposed to diesel exhaust as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.3.2-17, the applicant proposed to manage cumulative fatigue damage of stainless steel expansion joints exposed to diesel exhaust as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In these LRA table 3.3.2-17, the applicant proposed for these systems that sight glass exposed to closed cycle cooling water would have no aging effect requiring management and, there would be no aging management program. The combination of glass and closed cycle cooling water is not a material/environment combination covered in GALL. However, there are similar material/environment combinations covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-17 the applicant proposed to manage cracking of copper alloy >15% Zn valve bodies exposed to fuel oil using the Fuel Oil Chemistry and One-Time Inspection Programs. During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results line that references Note H and determined that the aging effect for the component type, material, and environment are not within the GALL Report.

The staff noted that the applicant’s proposed programs would be effective in preventing, monitoring, and detecting this aging effect because the Fuel Oil Chemistry Program mitigates conditions conducive to cracking by ensuring that fuel oil chemistry parameters are kept within those specified by ASTM Standards. Further, the One-Time Inspection Program verifies the effectiveness of the Fuel Oil Chemistry Program by inspecting for the occurrences of the aging effects. The staff’s evaluation of the Fuel Oil Chemistry Program is documented in SER Section 3.0.3.2.8. The staff’s evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this aging effect is appropriate and will be adequately managed by the Fuel Oil Chemistry Program and the One-Time Inspection Program.

In LRA Table 3.3.2-17, the applicant proposed to manage loss of material in aluminum strainer bodies exposed to lubricating oil using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note G to these items. The staff reviewed the AMR results lines that reference Note G. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Lubricating oil is not an environment covered in the GALL Report for loss of material of aluminum strainer bodies. However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing, removing impurities conducive to loss of material. Additionally, any evidence of loss of material would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-17, the applicant proposed to manage reduction of heat transfer in aluminum heat exchanger (fin) exposed to air - outdoor – EXT using the External Surfaces Monitoring Program (B.2.15). During its review, the staff noted that the applicant applied Note H to this item. The staff reviewed the AMR results line that reference Note H. The External Surfaces Monitoring Program was reviewed by the staff in SER Section 3.0.3.1.9. Reduction of heat transfer is not an aging effect covered in the GALL Report for aluminum heat exchanger (fin) for which reduction of heat transfer is identified as an appropriate aging effect. However, the staff's evaluation of the External Surfaces Monitoring Program finds that it would be effective in identifying evidence of deposit buildup that would contribute towards this aging effect. The program directs actions to clean or remove the material when identified. Therefore, the staff finds that this line item is acceptable.

In LRA Table 3.3.2-17, the applicant proposed to manage loss of material in aluminum heat exchanger (fin) exposed to lubricating oil – EXT using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note G to these items. The staff reviewed the AMR results lines that reference Note G. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Lubricating oil – EXT is not an environment covered in the GALL Report for loss of material of aluminum heat exchanger (fin). However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing, removing impurities conducive to loss of material. Additionally, any evidence of loss of material would be effectively identified by the One-Time Inspection Program. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-17, the applicant proposed to manage reduction of heat transfer in aluminum heat exchanger (fin) exposed to lubricating oil – EXT using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note G to these items. The staff reviewed the AMR results lines that reference Note G. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Lubricating oil – EXT is not an environment covered in the GALL Report for reduction of heat transfer in aluminum heat exchanger (fin). However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing, removing impurities conducive to reduction of heat transfer. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program which directs that corrective actions be taken. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-17, the applicant proposed to manage reduction of heat transfer in copper alloy >15% Zn heat exchanger (tube and tubesheet) exposed to lubricating oil – EXT using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Reduction of heat transfer is not an aging effect covered in the GALL Report for copper alloy >15% Zn heat exchanger (tube and tubesheet) heat exchanger tubes or other heat transfer surfaces exposed to lubricating oil. However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing removing impurities conducive to reduction of heat transfer. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program which directs that corrective actions be taken. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-17, the applicant proposed to manage reduction of heat transfer in copper alloy >15% Zn heat exchanger (tube) exposed to air - outdoor – EXT using the External Surfaces Monitoring Program (B.2.15). During its review, the staff noted that the applicant applied Note H to this item. The staff reviewed the AMR results lines that reference Note H. The External Surfaces Monitoring Program was reviewed by the staff in SER Section 3.0.3.1.9. Reduction of heat transfer is not an aging effect covered in the GALL Report for copper alloy >15% Zn heat exchanger (tube) for which reduction of heat transfer is identified as an appropriate aging effect. However, the staff's evaluation of the External Surfaces Monitoring Program finds that it would be effective in identifying evidence of deposit buildup that would contribute towards this aging effect. The program directs actions to clean or remove the material when identified. Therefore, the staff finds that this line item is acceptable.

In LRA Table 3.3.2-17, the applicant proposed to manage cracking of the elastomeric expansion joints exposed to indoor uncontrolled air-EXT and indoor uncontrolled-air environments using the External Surface Monitoring Program.

<u>Assessment of Applicable Aging Effects</u>. The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review, the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F.

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.
The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21. 2008, the applicant explained, that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as “short-lived” and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components and because this meets that staff’s LRA screening basis in 10 CFR 54.21(a)(1)(ii) that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, “wear” is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that as such, loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluated the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant’s basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking.

The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of “change in material properties.” The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, volume 2), Section IX.F, “Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms,” the staff groups “weathering” as an aging mechanism within the scope of the grouping “Elastomer degradation,” and defines "weathering" as “Degradation of external surfaces of materials when exposed to outside environment.” The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, do not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant’s UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicants response and finds that, chemical degradation of elastomer components in contact with a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated “short-lived.” On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), “short-lived” components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect “wear” is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant’s review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant’s response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

Assessment of the Applicant’s Aging Management Programs or Activities Credited for Aging Management**.** The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of flexible connection exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant’s External Surfaces Monitoring Program is GALL AMP XI.M36, “External Surfaces Monitoring.” The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, “External Surfaces Monitoring,” is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, “External Surfaces Monitoring,” does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, “External Surfaces Monitoring,” does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant’s program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing cracking. The applicant’s program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in: (1) the elastomeric auxiliary system components that are exposed, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed externally to uncontrolled indoor air.

In its response dated July 21, 2008, the applicant explained that, as identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as “short-lived” and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the replacement activities will be determined based upon manufacturer recommendations and operating experience, and that the flexible hoses (non-flexible ventilation connection components) in the auxiliary feedwater system are, therefore, classified as short-lived and excluded from aging management review. The staff’s basis for concluding that the non-flexible ventilation connection components in the auxiliary systems do not need to be subject to an AMR or to any AMPs for aging management has been discussed previously in the *Assessment of Applicable Aging Effects* portion of this evaluation.

In regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, “External Surfaces Monitoring. The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers in noticed (such as a change in strength or hardness of the material).

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, the based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surfaces Monitoring Program. The External Surfaces Monitoring Program will be representative of the conditions on the internal surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant's letter of July 21, 2008. Based on the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-17, the applicant states that (1) polymeric piping exposed fuel oil, indoor uncontrolled air-EXT, and soil-EXT experience no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

Assessment of the Applicant's Identification of Aging Effects. The staff reviewed the applicant's AMRs for the component-polymer-environment combinations listed in Table 3.3.2.3-3 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for the polymer auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water. The component-polymer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI # 3.3.2.3-4 to request identification of the specific polymer materials that were used in fabrication of the components listed in these auxiliary system AMR items and to provide a more detailed technical basis on whether there are any AERMs for the component-polymer material-environment combinations in these AMRs.

In its letter dated July 21, 2008, the applicant explained that it has reviewed details associated with the various polymer components addressed in the LRA. The applicant stated that Polymer hoses in the Halon fire protection subsystems are periodically tested and replaced on condition, and, therefore, are considered consumables as described in LRA Section 2.1.2.4.3.

The applicant stated that the BVPS LRA is revised to include a new License Renewal Future Commitment to address the remaining polymer components. The applicant explained that specifically, with the exception noted in this response, it will perform repetitive maintenance tasks prior to the period of extended operation, to periodically replace, or to periodically test and replace on condition, polymer components identified in LRA Sections 3.1, 3.2, 3.3 and 3.4 such that those components are classified as "short-lived" and not subject to aging management, per

10 CFR 54.21 (a)(1)(ii). The applicant identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience.

The applicant stated that the exception to testing/replacement of polymers by preventive maintenance is GeoFlex®-D piping used as the buried fuel oil piping in the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems.

The applicant stated that the LRA is further revised to delete, as appropriate, the polymer component types, materials and aging effects from the LRA Table 2s and the summary lists of materials and environments in LRA Sections 3.1, 3.2, 3.3 and 3.4. The applicant referred to the Enclosure to this letter for the revision to the BVPS LRA.

In response to the first part of this RAI, which asks the identity of the polymeric material from which the polymer subject to AMR is manufactured, the applicant states that the GeoFlex®-D piping is a double-walled, flexible piping system designed for direct burial and that GeoFlex® pipe is a totally-bonded, multi-layer composite construction with braided fiber reinforcement. The applicant further explained that the inner-most Kynar® (polyvinylidene fluoride) barrier layer is impermeable to diesel fuel and that the exterior has a nylon barrier layer to protect the outer wall from chemical and microbial attack. The applicant also stated that additional intermediate layers are made of polyethylene and nylon.

In response to the second part of this RAI, which asks whether the polymer is elastomeric, thermoplastic, or thermoset material in order to identify their age-related degradation mechanisms, the applicant stated that Kynar®, nylon and polyethylene are thermoplastics. The applicant further stated that it used the EPRI Mechanical Tools to determine that polymers, such as those used in GeoFlex® piping, are either completely resistant to the fluid environment, or they deteriorate. Further the applicant stated that unlike metals, plastics do not display corrosion rates. The applicant explained that rather than depending upon an oxide layer for protection, plastics depend upon chemical resistance to the environment to which they are exposed. The applicant further explained that acceptability for the use of plastics within a given environment is a design-driven criterion; once the appropriate material is chosen, the system will have no aging effects due to exposure to the contained fluid however, chemical decomposition due to exposure to ozone and ultraviolet or ionizing radiation is a potential aging effect for some polymers.

In response to the third part of this RAI, which asks about the particular environment to which each polymer subject to AMR is exposed and its AERMs, the applicant stated that the materials of construction of GeoFlex® piping were specifically chosen for use in transporting fuel oils and for direct burial. The applicant identified that the product is Underwriters Laboratories (UL) listed for this application. Further, the applicant stated that the soil environment precludes exposure to ozone and to ultraviolet and ionizing radiation. The applicant referenced an April 22, 1997, U.S. Environmental Protection Agency Memo (from Anna Hopkins Virbick, Director, Office of Underground Storage Tanks, to Environmental Protection Agency UST/LUST Regional Program Managers and State UST Program Managers - Subject: Transmittal of Survey of Flexible Piping Systems) transmitted the results of a survey of flexible piping used in underground fuel oil delivery systems, and included evaluation of GeoFlex® operating experience. The applicant stated that the survey concluded that problems with the systems have been infrequent, and the performance of the technology has been excellent.

The applicant concluded that based on this review of industry operating experience and the use of proper design and application of the material, GeoFlex® piping materials with internal fuel oil and external buried (soil) environments do not exhibit aging effects requiring management.

The staff reviewed the applicant’s response to RAI 3.3.2.3-4 and its revised LRA which includes a new License Renewal Future Commitment to address the polymer components subject to AMR, and finds that it adequately explains that with the exception of the underground fuel oil piping servicing the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems, all the polymeric material previously described in the LRA Table 2’s are now designated as short-lived. The staff further evaluated the applicant’s explanation that the short-lived polymeric components will be subject to periodic testing and replacement activities based on manufacturer’s recommendations and operating experience. The staff also evaluated the applicant’s response concerning Halon system fire hoses and finds that they are consumable items under LRA Section 2.1.2.4.3.

The staff reviewed the applicant’s explanation of the fuel oil piping to the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems which it identified as GeoFlex® D. The staff finds that this material is a polymer similar to polymers used in other nuclear plant applications such as fiberglass and PVC and therefore, will not result in aging that will be of concern during the period of extended operation and that because the piping was designed for direct burial, there are no AERMs requiring management. Therefore, the staff’s concern in RAI 3.3.2.3-4 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.18 Fire Protection System - Summary of Aging Management Evaluation – LRA Table 3.3.2-18

The staff reviewed LRA Table 3.3.2-18, which summarizes the results of AMR evaluations for the fire protection system component groups.

In LRA Table 3.3.2-18, the applicant proposed to manage cumulative fatigue damage of stainless steel expansion joints exposed to diesel exhaust and steel piping and exhaust silencer exposed to diesel exhaust as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In these LRA table 3.3.2-18, the applicant proposed for these systems that sight glass exposed to condensation would have no aging effect requiring management and, there would be no aging management program. Condensation is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-18, the applicant provided its plant-specific AMR for managing loss of material in external copper alloy >15% Zn valve body (CO_2 and Halon) surfaces that are exposed condensation environment. In this AMR, the applicant credited its Selective Leaching Program to manage this aging effect.

The staff noted that in Section VII of the GALL Report includes numerous AMR items (e.g., GALL AMRs VII.F4-13 and VII.G-13) on management of loss of material due to selective leaching in copper with greater than 15% zinc components that are exposed to wetted environments. The applicant has conservatively assumed that these copper valve bodies may be subject to selective leaching if exposed to condensation and has credited its Selective Leaching Program to manage this aging effect/mechanism in these components. The staff finds this to be acceptable because it is consistent with the AMRs of the GALL Report for using Selective Leaching Programs to manage loss of material that can occur in this category of components (i.e. those fabricated from copper with greater than 15% zinc alloying content) as a result of selective leaching.

In LRA Table 3.3.2-18, the applicant states that polymeric flexible hoses (Halon) exposed to gas and indoor uncontrolled air-EXT experience no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

Assessment of the Applicant's Identification of Aging Effects. The staff reviewed the applicant's AMRs for the component-polymer-environment combinations listed in Table 3.3.2.3-3 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for the polymer auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water. The component-polymer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI 3.3.2.3-4 to request identification of the specific polymer materials that were used in fabrication of the components listed in these auxiliary system AMR items and to provide a more detailed technical basis on whether there are any AERMs for the component-polymer material-environment combinations in these AMRs.

In its letter dated July 21, 2008, the applicant explained that it has reviewed details associated with the various polymer components addressed in the LRA. The applicant stated that Polymer hoses in the Halon fire protection subsystems are periodically tested and replaced on condition, and, therefore, are considered consumables as described in LRA Section 2.1.2.4.3.

The applicant stated that the BVPS LRA is revised to include a new License Renewal Future Commitment to address the remaining polymer components. The applicant explained that specifically, with the exception noted in this response, it will perform repetitive maintenance tasks prior to the period of extended operation, to periodically replace, or to periodically test and replace on condition, polymer components identified in LRA Sections 3.1, 3.2, 3.3 and 3.4 such that those components are classified as "short-lived" and not subject to aging management, per 10 CFR 54.21 (a)(1)(ii). The applicant identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience.

The applicant stated that the exception to testing/replacement of polymers by preventive maintenance is GeoFlex®-D piping used as the buried fuel oil piping in the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems.

The applicant stated that the LRA is further revised to delete, as appropriate, the polymer component types, materials and aging effects from the LRA Table 2s and the summary lists of materials and environments in LRA Sections 3.1, 3.2, 3.3 and 3.4. The applicant referred to the Enclosure to this letter for the revision to the BVPS LRA.

In response to the first part of this RAI, which asks the identity of the polymeric material from which the polymer subject to AMR is manufactured, the applicant states that the GeoFlex®-D piping is a double-walled, flexible piping system designed for direct burial and that GeoFlex® pipe is a totally-bonded, multi-layer composite construction with braided fiber reinforcement. The applicant further explained that the inner-most Kynar® (polyvinylidene fluoride) barrier layer is impermeable to diesel fuel and that the exterior has a nylon barrier layer to protect the outer wall from chemical and microbial attack. The applicant also stated that additional intermediate layers are made of polyethylene and nylon.

In response to the second part of this RAI, which asks whether the polymer is elastomeric, thermoplastic, or thermoset material in order to identify their age-related degradation mechanisms, the applicant stated that Kynar®, nylon and polyethylene are thermoplastics. The applicant further stated that it used the EPRI Mechanical Tools to determine that polymers, such as those used in GeoFlex® piping, are either completely resistant to the fluid environment, or they deteriorate. Further the applicant stated that unlike metals, plastics do not display corrosion rates. The applicant explained that rather than depending upon an oxide layer for protection, plastics depend upon chemical resistance to the environment to which they are exposed. The applicant further explained that acceptability for the use of plastics within a given environment is a design-driven criterion; once the appropriate material is chosen, the system will have no aging effects due to exposure to the contained fluid however, chemical decomposition due to exposure to ozone and ultraviolet or ionizing radiation is a potential aging effect for some polymers.

In response to the third part of this RAI, which asks about the particular environment to which each polymer subject to AMR is exposed and its AERMs, the applicant stated that the materials of construction of GeoFlex® piping were specifically chosen for use in transporting fuel oils and for direct burial. The applicant identified that the product is Underwriters Laboratories (UL) listed for this application. Further, the applicant stated that the soil environment precludes exposure to ozone and to ultraviolet and ionizing radiation. The applicant referenced an April 22, 1997, U.S. Environmental Protection Agency Memo (from Anna Hopkins Virbick, Director, Office of Underground Storage Tanks, to Environmental Protection Agency UST/LUST Regional Program Managers and State UST Program Managers - Subject: Transmittal of Survey of Flexible Piping Systems) transmitted the results of a survey of flexible piping used in underground fuel oil delivery systems, and included evaluation of GeoFlex® piping operating experience. The applicant stated that the survey concluded that problems with the systems have been infrequent, and the performance of the technology has been excellent.

The applicant concluded that based on this review of industry operating experience and the use of proper design and application of the material, GeoFlex® piping materials with internal fuel oil and external buried (soil) environments do not exhibit aging effects requiring management.

The staff reviewed the applicant's response to RAI 3.3.2.3-4 and its revised LRA which includes a new License Renewal Future Commitment to address the polymer components subject to AMR, and finds that it adequately explains that with the exception of the underground fuel oil piping servicing the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems, all the polymeric material previously described in the LRA Table 2's are now designated as short-lived. The staff further evaluated the applicant's explanation that the short-lived polymeric components will be subject to periodic testing and replacement activities based on manufacturer's recommendations and operating experience. The staff also evaluated the applicant's response concerning Halon system fire hoses and finds that they are consumable items under LRA Section 2.1.2.4.3.

The staff reviewed the applicant's explanation of the fuel oil piping to the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems which it identified as GeoFlex® D. The staff finds that this material is a polymer similar to polymers used in other nuclear plant applications such as fiberglass and PVC and therefore, will not result in aging that will be of concern during the period of extended operation and that because the piping was designed for direct burial, there are no AERMs requiring management. Therefore, the staff's concern in RAI 3.3.2.3-4 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.19 Fuel Pool Cooling and Purification System - Summary of Aging Management Evaluation – LRA Table 3.3.2-19

The staff reviewed LRA Table 3.3.2-19, which summarizes the results of AMR evaluations for the fuel pool cooling and purification system component groups.

In LRA Table 3.3.2-19, the applicant proposed to manage reduction of heat transfer in stainless steel heat exchanger (tube) exposed to treated borated water using a combination of the Water Chemistry Program (B.2.42) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note G to these items. The staff reviewed the AMR results lines that reference Note G. The Water Chemistry Program was reviewed by the staff in SER Section 3.0.3.2.14. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Treated borated water is not an environment covered in the GALL Report for reduction of heat transfer in stainless steel heat exchanger (tube). However, the staff's evaluation of the Water Chemistry Program finds that it would maintain treated water quality through treatment and testing, removing impurities conducive to causing reduction of heat transfer. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program which directs that corrective actions be taken. Therefore, the staff finds that these line items are acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.20 Gaseous Waste Disposal System - Summary of Aging Management Evaluation – LRA Table 3.3.2-20

The staff reviewed LRA Table 3.3.2-20, which summarizes the results of AMR evaluations for the gaseous waste disposal system component groups.

In this LRA Table 3.3.2-20, applicant proposed that sight glasses exposed to condensation would have no aging effect requiring management and, there would be no aging management program. Condensation is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In this LRA Table 3.3.2-20, the applicant proposed for that sight glass exposed to air with borated water leakage-external would have no aging effect requiring management and, there would be no aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.21 Liquid Waste Disposal System - Summary of Aging Management Evaluation – LRA Table 3.3.2-21

The staff reviewed LRA Table 3.3.2-21, which summarizes the results of AMR evaluations for the liquid waste disposal system component groups.

The staff determined that the LRA Table 3.1.2-2 did not include any plant-specific AMR items (as identified by either a Footnote F, G, H, I, or J designation) for the Liquid Waste Disposal components.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.22 Post-Accident Sample System - Summary of Aging Management Evaluation – LRA Table 3.3.2-22

The staff reviewed LRA Table 3.3.2-22, which summarizes the results of AMR evaluations for the post-accident sample system component groups.

The staff determined that the LRA Table 3.1.2-2 did not include any plant-specific AMR items (as identified by either a Footnote F, G, H, I, or J designation) for the Post-Accident Sample System components.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.23 Post-Design Basis Accident Hydrogen Control System - Summary of Aging Management Evaluation – LRA Table 3.3.2-23

The staff reviewed LRA Table 3.3.2-23, which summarizes the results of AMR evaluations for the post-design basis accident hydrogen control system component groups.

In Table 3.3.2-23, the applicant identified no aging effects for stainless steel piping exposed to an exterior environment of outdoor air. For these components the applicant cites Note G, which indicates that this environment is not in the GALL Report for this component and material. The staff finds that stainless steel material is susceptible to aging only if exposed to an aggressive chemical, salt water or buried environments. In a normal atmosphere environment, where rain water would tend to wash the exterior surface material rather than concentrate contaminants, the stainless steel material will have no aging effects. The SCC in stainless steel, which is considered plausible in wetted corrosive environments with a temperature greater than 140 ^{o}F, will not occur in the outside air environment. On this basis, the staff finds that stainless steel in an outside air environment exhibits no aging effect, and that the component or structure will remain capable of performing its intended functions consistent with the CLB during the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.24 Primary Component and Neutron Shield Tank Cooling Water System - Summary of Aging Management Evaluation – LRA Table 3.3.2-24

The staff reviewed LRA Table 3.3.2-24, which summarizes the results of AMR evaluations for the primary component and neutron shield tank cooling water system component groups.

In LRA table 3.3.2-24, the applicant proposed that sight glass exposed to condensation would have no aging effect requiring management and, there would be no aging management program. Condensation is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In these LRA table 3.3.2-24, the applicant proposed that sight glass exposed to Air with borated water leakage-external would have no aging effect requiring management and, there would be no aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In these LRA table 3.3.2-24, the applicant proposed that sight glass exposed to closed cycle cooling water would have no aging effect requiring management and, there would be no aging management program. The combination of glass and closed cycle cooling water is not a material/environment combination covered in GALL. However, there are similar material/environment combinations covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-24, the applicant proposed to manage reduction of heat transfer in copper alloy <15% Zn heat exchanger (RCP oil cooler tube) exposed to lubricating oil – EXT using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Reduction of heat transfer is not an aging effect covered in the GALL Report for copper alloy <15% Zn heat exchanger (RCP oil cooler tube) heat exchanger tubes or other heat transfer surfaces exposed to lubricating oil. However, the staff's evaluation of the Lubricating Oil Analysis Program finds that it would maintain lubricating oil quality through treatment and testing removing impurities conducive to reduction of heat transfer. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program which directs that corrective actions be taken. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-24, the applicant proposed to manage reduction of heat transfer in copper alloy <15% Zn heat exchanger (RCP oil cooler tube) exposed to air - indoor uncontrolled – EXT using the External Surfaces Monitoring Program (B.2.15). During its review, the staff noted that the applicant applied Note H to this item. The staff reviewed the AMR results line that references Note H. The External Surfaces Monitoring Program was reviewed by the staff in SER Section 3.0.3.1.9. Reduction of heat transfer is not an aging effect covered in GALL Report for copper alloy <15% Zn heat exchanger (RCP oil cooler tube) for which reduction of heat transfer is identified as an appropriate aging effect. However, the staff's evaluation of the External Surfaces Monitoring Program finds that it would be effective in identifying evidence of deposit buildup that would contribute towards this aging effect. Therefore, the staff finds that this line item is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.25 Radiation Monitoring System - Summary of Aging Management Evaluation – LRA Table 3.3.2-25

The staff reviewed LRA Table 3.3.2-25, which summarizes the results of AMR evaluations for the radiation monitoring system component groups.

In Table 3.3.2-25, the applicant identified no aging effects for stainless steel piping and isokinetic nozzle exposed to an exterior environment of outdoor air. For these components the applicant cites Note G, which indicates that the environment is not in the GALL Report for this component and material. The staff finds that stainless steel material is susceptible to aging only if exposed to an aggressive chemical, salt water or buried environments. In a normal atmosphere environment, where rain water would tend to wash the exterior surface material rather than concentrate contaminants, the stainless steel material will have no aging effects.

The SCC in stainless steel, which is considered plausible in wetted corrosive environments with a temperature greater than 140 °F , will not occur in the outside air environment. On this basis, the staff finds that stainless steel in an outside air environment exhibits no aging effect, and that the component or structure will remain capable of performing its intended functions consistent with the CLB during the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.26 Reactor Plant Sample System - Summary of Aging Management Evaluation – LRA Table 3.3.2-26

The staff reviewed LRA Table 3.3.2-26, which summarizes the results of AMR evaluations for the reactor plant sample system component groups.

In LRA Table 3.3.2-26, the applicant proposed to manage cumulative fatigue damage of stainless steel bolting exposed to uncontrolled indoor air on the external surface as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-26, the applicant proposed to manage loss of material of the copper alloy > 15% Zn valve bodies and gray cast iron pump casings in the reactor plant sample system that are exposed to condensation – using the Selective Leaching of Materials Inspection Program (B.2.36). The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.z. In LRA Table 3.3.2-26, the applicant proposed to manage loss of material of the gray cast iron pump casing exposed to condensation – external using the Selective Leaching of Materials Inspection Program (B.2.36). Condenstation – external is not an environment covered in the GALL Report. However, there are similar environments covered in the GALL Report for copper alloy >15% Zn and gray cast iron where loss of material is the aging effect requiring management and Selective Leaching of Materials (XI.M33) is the AMP. Because the environment, condensation - external, is similar to environments listed in the GALL Report, such as treated water, raw water, and closed cycle cooling water, the staff finds that this line item is acceptable

In this LRA table 3.3.2-26, the applicant proposed that sight glasses exposed to air with borated water leakage-external would have no aging effect requiring management and, there would be no aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-26, the applicant states that:

(1) polymeric demineralizers exposed to treated water, indoor uncontrolled air-EXT, and air with borated leakage- EXT.

(2) polymeric tank exposed to treated water, indoor uncontrolled air-EXT, and air with borated leakage-EXT.

(3) polymeric tubing exposed to treated borated water, treated water, indoor uncontrolled air-EXT, and air with borated leakage-EXT experience no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

Assessment of the Applicant's Identification of Aging Effects. The staff reviewed the applicant's AMRs for the component-polymer-environment combinations listed in Table 3.3.2-26 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for the polymer auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water. The component-polymer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2-26 above. The staff issued RAI 3.3.2.3-4 to request identification of the specific polymer materials that were used in fabrication of the components listed in these auxiliary system AMR items and to provide a more detailed technical basis on whether there are any AERMs for the component-polymer material-environment combinations in these AMRs.

In its letter dated July 21, 2008, the applicant explained that it has reviewed details associated with the various polymer components addressed in the LRA. The applicant stated that Polymer hoses in the Halon fire protection subsystems are periodically tested and replaced on condition, and, therefore, are considered consumables as described in LRA Section 2.1.2.4.3.

The applicant stated that the BVPS LRA is revised to include a new License Renewal Future Commitment to address the remaining polymer components. The applicant explained that specifically, with the exception noted in this response, it will perform repetitive maintenance tasks prior to the period of extended operation, to periodically replace, or to periodically test and replace on condition, polymer components identified in LRA Sections 3.1, 3.2, 3.3 and 3.4 such that those components are classified as "short-lived" and not subject to aging management, per 10 CFR 54.21 (a)(1)(ii). The applicant identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience.

The applicant stated that the exception to testing/replacement of polymers by preventive maintenance is GeoFlex®-D piping used as the buried fuel oil piping in the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems.

The applicant stated that the LRA is further revised to delete, as appropriate, the polymer component types, materials and aging effects from the LRA Table 2's and the summary lists of materials and environments in LRA Sections 3.1, 3.2, 3.3 and 3.4. The applicant referred to the Enclosure to this letter for the revision to the BVPS LRA.

In response to the first part of this RAI, which asks the identity of the polymeric material from which the polymer is subject to AMR is manufactured, the applicant states that the GeoFlex®-D piping is a double-walled, flexible piping system designed for direct burial and that GeoFlex® pipe is a totally-bonded, multi-layer composite construction with braided fiber reinforcement. The applicant further explained that the inner-most Kynar® (polyvinylidene fluoride) barrier layer is impermeable to diesel fuel and that the exterior has a nylon barrier layer to protect the outer wall from chemical and microbial attack. The applicant also stated that additional intermediate layers are made of polyethylene and nylon.

In response to the second part of this RAI, which asks whether the polymer is elastomeric, thermoplastic, or thermoset material in order to identify their age-related degradation mechanisms, the applicant stated that Kynar®, nylon and polyethylene are thermoplastics. The applicant further stated that it used the EPRI Mechanical Tools to determine that polymers, such as those used in GeoFlex® piping, are either completely resistant to the fluid environment, or they deteriorate. Further the applicant stated that unlike metals, plastics do not display corrosion rates. The applicant explained that rather than depending upon an oxide layer for protection, plastics depend upon chemical resistance to the environment to which they are exposed. The applicant further explained that acceptability for the use of plastics within a given environment is a design-driven criterion; once the appropriate material is chosen, the system will have no aging effects due to exposure to the contained fluid however, chemical decomposition due to exposure to ozone and ultraviolet or ionizing radiation is a potential aging effect for some polymers.

In response to the third part of this RAI, which asks about the particular environment to which each polymer subject to AMR is exposed and its AERMs, the applicant stated that the materials of construction of GeoFlex® piping were specifically chosen for use in transporting fuel oils and for direct burial. The applicant identified that the product is Underwriters Laboratories (UL) listed for this application. Further, the applicant stated that the soil environment precludes exposure to ozone and to ultraviolet and ionizing radiation. The applicant referenced an April 22, 1997, U.S. Environmental Protection Agency Memo (from Anna Hopkins Virbick, Director, Office of Underground Storage Tanks, to Environmental Protection Agency UST/LUST Regional Program Managers and State UST Program Managers - Subject: Transmittal of Survey of Flexible Piping Systems) transmitted the results of a survey of flexible piping used in underground fuel oil delivery systems, and included evaluation of GeoFlex® operating experience. The applicant stated that the survey concluded that problems with the systems have been infrequent, and the performance of the technology has been excellent.

The applicant concluded that based on this review of industry operating experience and the use of proper design and application of the material, GeoFlex® piping materials with internal fuel oil and external buried (soil) environments do not exhibit aging effects requiring management.

The staff reviewed the applicant's response to RAI 3.3.2.3-4 and its revised LRA which includes a new License Renewal Future Commitment to address the polymer components subject to AMR, and finds that it adequately explains that with the exception of the underground fuel oil piping servicing the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems, all the polymeric material previously described in the LRA Table 2's are now designated as short-lived. The staff further evaluated the applicant's explanation that the short-lived polymeric components will be subject to periodic testing and replacement activities based on manufacturer's recommendations and operating experience. The staff also evaluated the applicant's response concerning Halon system fire hoses and finds that they are consumable items under LRA Section 2.1.2.4.3.

The staff reviewed the applicant's explanation of the fuel oil piping to the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems which it identified as GeoFlex® D. The staff finds that this material is a polymer similar to polymers used in other nuclear plant applications such as fiberglass and PVC and therefore, will not result in aging that will be of concern during the period of extended operation and that because the piping was designed for direct burial, there are no AERMs requiring management. Therefore, the staff's concern in RAI 3.3.2.3-4 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.27 Reactor Plant Vents and Drains - Summary of Aging Management Evaluation – LRA Table 3.3.2-27

The staff reviewed LRA Table 3.3.2-27, which summarizes the results of AMR evaluations for the reactor plant vents and drains component groups.

In LRA Table 3.3.2-27, the applicant proposed to manage cumulative fatigue damage of stainless steel bolting exposed to uncontrolled indoor air on the external surface as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-27, the applicant proposed to manage loss of material of the gray cast iron trap body exposed to condensation – external using the Selective Leaching of Materials Inspection Program (B.2.36). The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.3.6. Condensation – external is not an environment covered in the GALL Report. However, there are similar environments covered in the GALL Report for gray cast iron where loss of material is the aging effect requiring management and Selective Leaching of Materials (XI.M33) is the AMP. Because the environment, condensation - external, is similar to environments listed in the GALL Report, such as treated water, raw water, and closed cycle cooling water, the staff finds that this line item is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.28 River Water System (Unit 1 only) - Summary of Aging Management Evaluation – LRA Table 3.3.2-28

The staff reviewed LRA Table 3.3.2-28, which summarizes the results of AMR evaluations for the river water system (Unit 1 only) component groups.

In LRA Table 3.3.2-28, the applicant proposed to manage loss of material of the gray cast iron Condenser (ACU waterbox/cover), strainer body, and valve body exposed to condensation – external using the Selective Leaching of Materials Inspection Program (B.2.36). The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.z. Condensation – external is not an environment covered in the GALL Report. However, there are similar environments covered in the GALL Report for gray cast iron where loss of material is the aging effect requiring management and Selective Leaching of Materials (XI.M33) is the AMP. Because the environment, condensation - external, is similar to environments listed in the GALL Report, such as treated water, raw water, and closed cycle cooling water, the staff finds that this line item is acceptable.

In this LRA Table 3.3.2-28, the applicant proposed that sight glasses exposed to condensation would have no aging effect requiring management and, there would be no aging management program. Condensation is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.29 Security Diesel Generator System (Common) - Summary of Aging Management Evaluation – LRA Table 3.3.2-29

The staff reviewed LRA Table 3.3.2-29, which summarizes the results of AMR evaluations for the security diesel generator system (common) component groups.

In LRA Table 3.3.2-29, the applicant proposed to manage cumulative fatigue damage of steel piping and turbocharger housings exposed to diesel exhaust as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.3.2-29, the applicant proposed to manage cumulative fatigue damage of stainless steel flexible hoses exposed to diesel exhaust as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-29, the applicant proposed to manage reduction of heat transfer in copper alloy >15% Zn heat exchanger (oil cooler - tube) exposed to lubricating oil using a combination of the Lubricating Oil Analysis Program (B.2.24) and the One-Time Inspection Program (B.2.30). During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results lines that reference Note H. The Lubricating Oil Analysis Program was reviewed by the staff in SER Section 3.0.3.1.13. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Reduction of heat transfer is not an aging effect covered in the GALL Report for copper alloy >15% Zn heat exchanger (oil cooler - tube) heat exchanger tubes or other heat transfer surfaces exposed to lubricating oil. However, the staff's evaluation of the Lubricating Oil Analysis Program, finds that it would maintain lubricating oil quality through treatment and testing removing impurities conducive to reduction of heat transfer. Additionally, any evidence of reduction of heat transfer would be effectively identified by the One-Time Inspection Program which directs that corrective actions be taken. Therefore, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-29, the applicant proposed to manage reduction of heat transfer in steel heat exchanger (radiator) exposed to indoor uncontrolled air– EXT using the External Surfaces Monitoring Program (B.2.15). During its review, the staff noted that the applicant applied Note H to this item and provided clarification by plant-specific Note 313. The staff reviewed the AMR results line that reference Note H. The External Surfaces Monitoring Program was reviewed by the staff in SER Section 3.0.3.1.9. Reduction of heat transfer is not an aging effect covered in the GALL Report for steel heat exchanger (radiator) for which reduction of heat transfer is identified as an appropriate aging effect. However, the staff's evaluation of the External Surfaces Monitoring Program finds that it would be effective in identifying evidence of deposit buildup that would contribute towards this aging effect. The program directs actions to clean or remove the material when identified. The staff reviewed plant-specific Note 313, which states that reduction of heat transfer by fins due to buildup of particulate on external surfaces. The staff noted that the applicant's proposed program would be effective in monitoring and detecting this aging effect because it would perform visual inspections of the external surfaces of the heat exchanger surfaces during the performance of maintenance activities when they are made accessible. On this basis, the staff finds that this aging effect will be adequately managed by the External Surfaces Monitoring Program. Therefore, the staff finds that this line item is acceptable.

In LRA Table 3.3.2-29 the applicant proposed to manage cracking of copper alloy >15% Zn orifices, piping (fittings), pump casings, and valve bodies exposed to fuel oil using the Fuel Oil Chemistry and One-Time Inspection Programs. During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results line that references Note H and determined that the aging effect for the component type, material, and environment are not within the GALL Report.

The staff noted that the applicant's proposed programs would be effective in preventing, monitoring, and detecting this aging effect because the Fuel Oil Chemistry Program mitigates conditions conducive to cracking by ensuring that fuel oil chemistry parameters are kept within those specified by ASTM Standards. Further, the One-Time Inspection Program verifies the effectiveness of the Fuel Oil Chemistry Program by inspecting for the occurrences of the aging effects. The staff's evaluation of the Fuel Oil Chemistry Program is documented in SER Section 3.0.3.2.8. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this aging effect is appropriate and will be adequately managed by Fuel Oil Chemistry Program and the One-Time Inspection Program. Therefore, the staff finds that this line item is acceptable.

In LRA Table 3.3.2-29, the applicant proposed to manage cracking of the elastomeric flexible hoses exposed to indoor uncontrolled air-EXT and indoor uncontrolled-air environments using the External Surface Monitoring Program.

<u>Assessment of Applicable Aging Effects</u>. The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to indoor uncontrolled air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F.

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.

The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21, 2008, the applicant explained, that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to RAI 3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as “short-lived” and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components and because this meets the staff’s LRA screening basis in 10 CFR 54.21(a)(1)(ii) that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, “wear” is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluate the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant’s basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components, are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking. The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of “change in material properties.” The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, Volume 2), Section IX.F, “Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms,” the staff groups “weathering” as an aging mechanism within the scope of the grouping “Elastomer degradation,” and defines "weathering" as “Degradation of external surfaces of materials when exposed to outside environment.” The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, does not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant’s UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections, because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicant’s response and finds that, chemical degradation of elastomer components in contact a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated “short-lived.” On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), “short-lived” components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect “wear” is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant’s review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant’s response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

<u>Assessment of the Applicant’s Aging Management Programs or Activities Credited for Aging Management</u>. The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of flexible connection exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant’s External Surfaces Monitoring Program is GALL AMP XI.M36, “External Surfaces Monitoring.” The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, “External Surfaces Monitoring,” is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, “External Surfaces Monitoring,” does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, “External Surfaces Monitoring,” does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant's program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing cracking. The applicant's program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in: (1) the elastomeric auxiliary system components that are exposed, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems, that are exposed externally to uncontrolled indoor air.

In its response dated July 21, 2008, the applicant explained that, as identified in the response to RAI 3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the replacement activities will be determined based upon manufacturer recommendations and operating experience, and that the flexible hoses (non-flexible ventilation connection components) in the auxiliary feedwater system are, therefore, classified as short-lived and excluded from aging management review. The staff's basis for concluding that the non-flexible ventilation connection components in the auxiliary systems do not need be subject to an AMR or to any AMPs for aging management has been discussed previously in the *Assessment of Applicable Aging Effects* portion of this evaluation.

In regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited it's External Surfaces Monitoring Program, to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, "External Surfaces Monitoring. The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers is noticed (such as a change in strength or hardness of the material).

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surfaces Monitoring Program . The External Surfaces Monitoring Program will be representative of the conditions on the internal surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configured cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant's letter of July 21, 2008. Based on the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that the applicant has resolved the staff's concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

Conclusion. On the basis of its review the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-29, the applicant states that elastomeric flexible hoses exposed to closed cycle cooling water, fuel oil, and lubricating oil experience no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

The staff reviewed the applicant's AMRs for the component-elastomer-environment combinations listed in Table 3.3.2.3-2 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for: (1) the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed to either lubricating oil or externally to an borated water leakage environment. The component-elastomer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI 3.3.2.3-3/3.4.2.3-3 to request identification of the specific elastomeric materials that were used in fabrication of the elastomeric components listed in these auxiliary AMR items (and for the flexible hoses in the auxiliary feedwater systems) and to provide a more detailed technical basis on whether there are any AERMs for the component-elastomer material-environment combinations in these AMRs.

The applicant responded to RAI 3.3.2.3-3/3.4.2.3-3 in a letter dated July 21, 2008. In its response, the applicant stated that BVPS LRA is revised to include a new License Renewal Future Commitment to address elastomeric components. The applicant clarified that with the exception of elastomeric flexible ventilation connection components in the control area and plant are ventilation systems, the applicant will perform repetitive maintenance tasks and periodic replacement of the elastomeric components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 prior to the period of extended operation, such that the components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii). The applicant also identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience. The staff noted that replacing these elastomeric components on a frequency that is consistent with the vendor recommendations provides an acceptable basis for replacing these components on a specified qualified life. The staff verified that, in the applicant's letter of July 21, 2008, the applicant appropriately amended the LRA to delete the AMRs for these components from the scope of the LRA and to instead amend the application to incorporate these components into a periodic replacement program under LRA Commitment No. 21 in UFSAR Supplement Table A.4-1 for Unit and Commitment No. 23 in UFSAR Supplement Table A.5-1 for Unit 2. Thus, based on this review, the staff finds this to be an acceptable basis for not including these elastomeric components within the scope of an AMR because the components will be replaced on a specified qualified life for the components such that the components are not required to be subject to an aging management review in accordance with the requirements of 10 CFR 54.21(a)(1)(i) and (ii).

For the elastomeric flexible connection components in the control area and plant area ventilation systems (i.e. flexible ventilation connection components) the applicant explained that the components will remain categorized as “long-lived” and will remain subject to aging management review. For these components, with respect to the applicant’s response to RAI 3.3.2.3-3/3.4.2.3-3, Part 1, the applicant clarified that the elastomeric flexible ventilation connection components are fabricated of fiberglass, with double coated with neoprene (polychloroprene) on the internal and external fiberglass surfaces. The staff reviewed the applicant’s response to 3.3.2.3-3/3.4.2.3-3, Part 1, and finds that it adequately resolved the question raised in the RAI because the response clearly identified the elastomeric material that was used in the fabrication of the elastomeric components mentioned in these plant-specific AMR items. RAI 3.3.2.3-3/3.4.2.3-3, Part 1 is resolved.

In its response to RAI 3.3.2.3-3/3.4.2.3-3,, Parts 2 and 3, the applicant stated that according to the EPRI Structural Tools, Section 7.1.1:

> “Neoprene is chemically and structurally similar to natural rubber, and its mechanical properties are also similar. This resistance to oils, chemicals, sunlight, weathering, aging and ozone is outstanding. It retains its properties at temperatures up to 250°F.”

The applicant further explained that the EPRI Structural Tools identifies various changes in elastomer properties that corresponded to the aging effects identified as “cracking” and as “hardening and loss of strength” in the GALL Report, and that the environmental conditions that might result in these aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant clarified that neoprene is relatively insensitive to temperature, ozone, and ultraviolet and ionizing radiation exposure, but the potential for the GALL Report aging effects of “cracking and “hardening and loss of strength” was not excluded for neoprene aging evaluations. The applicant explained that it assigned both “Air-indoor uncontrolled” and “Air with borated water leakage” environments to in-scope components in areas containing borated water systems. Where the external environment of “Air with borated water leakage” exists, the environment of “Air-indoor uncontrolled” is also evaluated. However, the applicant clarified that the presence of boric acid leakage does not result in additional aging effects for elastomers in general or neoprene specifically, and that as a result of these determination, no additional aging effects were identified for the neoprene surfaces that are associated specifically with an air with borated water leakage environment.

The staff noted that the aging effects identified by the applicant for these elastomeric flexible ventilation connection components were consistent with the aging effects for elastomeric components listed in Section VII of the GALL Report, Volume 2. Based on this review, the staff finds that it adequately resolved the staff’s inquiry on the aging effects that are applicable to these elastomeric components because the applicant has identified cracking and changes in the hardness or strength properties are the aging effects requiring management for the surfaces that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water and because the staff has verified that this is in conformance with the applicable aging effects that are listed for elastomeric components in the AMRs of Section VII of the GALL Report, Volume 2.

The staff noted that for the elastomeric flexible ventilation connection components in the BVPS control area and plant area ventilation systems, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in hardness or strength of the elastomeric flexible ventilation connection components. The staff also noted, that in the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2, dated July 21, 2008, the applicant clarified that the visual examinations of these flexible ventilation connection components would be supplemented by physical manipulations of the components in order to aid with the identification of cracking or any changes in the hardness or strength properties of the components.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests of these elastomeric components in the applicant's letter of July 21, 2008. Based on the applicant's response to RAIs 3.3.2.3-2/3.4.2.3-2 and 3.3.2.3-3/3.4.2.3-3 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that the applicant has resolved the staff's concerns and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing cracking in the components or any significant changes in the hardness or strength properties of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concerns in RAI 3.3.2.3-2/3.4.2.3-2 and RAI 3.3.2.3-3/3.4.2.3-3 are resolved.

<u>Conclusion</u>. On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-29, the applicant states that polymeric piping (GeoFlex® fuel oil lines) exposed to indoor uncontrolled air, fuel oil, and soil-EXT experience no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

Assessment of the Applicant's Identification of Aging Effects. The staff reviewed the applicant's AMRs for the polymer-material environment combinations listed in Table 3.3.2.3-3 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for the polymer auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water. The component-polymer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI 3.3.2.3-4 to request identification of the specific polymer materials that were used in fabrication of the components listed in these auxiliary system AMR items and to provide a more detailed technical basis on whether there are any AERMs for the component-polymer material-environment combinations in these AMRs.

In its letter dated July 21, 2008, the applicant explained that it has reviewed details associated with the various polymer components addressed in the LRA. The applicant stated that Polymer hoses in the Halon fire protection subsystems are periodically tested and replaced on condition, and, therefore, are considered consumables as described in LRA Section 2.1.2.4.3.

The applicant stated that the BVPS LRA is revised to include a new License Renewal Future Commitment to address the remaining polymer components. The applicant explained that specifically, with the exception noted in this response, it will perform repetitive maintenance tasks prior to the period of extended operation, to periodically replace, or to periodically test and replace on condition, polymer components identified in LRA Sections 3.1, 3.2, 3.3 and 3.4 such that those components are classified as "short-lived" and not subject to aging management, per 10 CFR 54.21 (a)(1)(ii). The applicant identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience.

The applicant stated that the exception to testing/replacement of polymers by preventive maintenance is GeoFlex®-D piping used as the buried fuel oil piping in the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems.

The applicant stated that the LRA is further revised to delete, as appropriate, the polymer component types, materials and aging effects from the LRA Table 2s and the summary lists of materials and environments in LRA Sections 3.1, 3.2, 3.3 and 3.4. The applicant referred to the Enclosure to this letter for the revision to the BVPS LRA.

In response to the first part of this RAI, which asks the identity of the polymeric material from which the polymer subject to AMR is manufactured, the applicant states that the GeoFlex®-D piping is a double-walled, flexible piping system designed for direct burial and that GeoFlex®

pipe is a totally-bonded, multi-layer composite construction with braided fiber reinforcement. The applicant further explained that the inner-most Kynar® (polyvinylidene fluoride) barrier layer is impermeable to diesel fuel and that the exterior has a nylon barrier layer to protect the outer wall from chemical and microbial attack. The applicant also stated that additional intermediate layers are made of polyethylene and nylon.

In response to the second part of this RAI, which asks whether the polymer is elastomeric, thermoplastic, or thermoset material in order to identify their age-related degradation mechanisms, the applicant stated that Kynar®, nylon and polyethylene are thermoplastics. The applicant further stated that it used the EPRI Mechanical Tools to determine that polymers, such as those used in GeoFlex® piping, are either completely resistant to the fluid environment, or they deteriorate. Further the applicant stated that unlike metals, plastics do not display corrosion rates. The applicant explained that rather than depending upon an oxide layer for protection, plastics depend upon chemical resistance to the environment to which they are exposed. The applicant further explained that acceptability for the use of plastics within a given environment is a design-driven criterion; once the appropriate material is chosen, the system will have no aging effects due to exposure to the contained fluid however, chemical decomposition due to exposure to ozone and ultraviolet or ionizing radiation is a potential aging effect for some polymers.

In response to the third part of this RAI, which asks about the particular environment to which each polymer subject to AMR is exposed and its AERMs, the applicant stated that the materials of construction of GeoFlex® piping were specifically chosen for use in transporting fuel oils and for direct burial. The applicant identified that the product is Underwriters Laboratories (UL) listed for this application. Further, the applicant stated that the soil environment precludes exposure to ozone and to ultraviolet and ionizing radiation. The applicant referenced an April 22, 1997, U.S. Environmental Protection Agency Memo (from Anna Hopkins Virbick, Director, Office of Underground Storage Tanks, to Environmental Protection Agency UST/LUST Regional Program Managers and State UST Program Managers - Subject: Transmittal of Survey of Flexible Piping Systems) transmitted the results of a survey of flexible piping used in underground fuel oil delivery systems, and included evaluation of GeoFlex® operating experience. The applicant stated that the survey concluded that problems with the systems have been infrequent, and the performance of the technology has been excellent.

The applicant concluded that based on this review of industry operating experience and the use of proper design and application of the material, GeoFlex® piping materials with internal fuel oil and external buried (soil) environments do not exhibit aging effects requiring management.

The staff reviewed the applicant’s response to RAI 3.3.2.3-4 and its revised LRA which includes a new License Renewal Future Commitment to address the polymer components subject to AMR, and finds that it adequately explains that with the exception of the underground fuel oil piping servicing the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems, all the polymeric material previously described in the LRA Table 2’s are now designated as short-lived. The staff further evaluated the applicant’s explanation that the short-lived polymeric components will be subject to periodic testing and replacement activities based on manufacturer’s recommendations and operating experience. The staff also evaluated the applicant’s response concerning Halon system fire hoses and finds that they are consumable items under LRA Section 2.1.2.4.3.

The staff reviewed the applicant's explanation of the fuel oil piping to the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems which it identified as GeoFlex® D. The staff finds that this material is a polymer similar to polymers used in other nuclear plant applications such as fiberglass and PVC and therefore, will not result in aging that will be of concern during the period of extended operation and that because the piping was designed for direct burial, there are no AERMs requiring management. Therefore, the staff's concern in RAI 3.3.2.3-4 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.30 Service Water System (Unit 2 only) - Summary of Aging Management Evaluation – LRA Table 3.3.2-30

The staff reviewed LRA Table 3.3.2-30, which summarizes the results of AMR evaluations for the service water system (Unit 2 only) component groups.

In LRA Table 3.3.2-30, the applicant provided its plant-specific AMR items for managing loss of material of stainless steel and CASS tubing and valve bodies, and nickel-alloy flexible hoses and piping that are externally exposed to an outdoor air environment. In these AMRs the applicant credited its External Surface Monitoring Program to manage loss of material in the external component surfaces that are exposed to outdoor air. For these components the applicant cites Note G, which indicates that environment is not in the GALL Report for this component and material. However, in other Tables in the LRA such as Table 3.3.2-14, 3.3.2-23, etc., there were no aging effects identified for stainless steel components in an external environment of outdoor air. The staff issued RAI 3.3.2.14-1 to request the applicant to justify why an aging effect is identified in this case and not in others.

In its letter dated July 24, 2008, the applicant stated that most air environments do not support corrosion of stainless steel. However, some specific "Air-outdoor" environment locations were evaluated with the potential for prolonged wetting, along with concentration of contaminants, which may lead to loss of material due to MIC, or due to pitting and/or crevice corrosion. The tubing and valve body in the Unit 2 service water system are located in the service water valve pit. The applicant revised the LRA to add Note 323 to Table 3.3.2-30, rows 97, 101, and 109, which states "this AMP applies only in the Service Water Valve Pit, where water pooling can result in a concentration of contaminants." Based on this note addition, the staff finds the response acceptable.

The staff's evaluation of the External Surface Monitoring Program is documented in SER Section 3.0.3.1.9. Although the GALL AMP XI.M36, External Surface Monitoring addresses only external surfaces of steel piping, the aging mechanism of general, pitting or crevice corrosion show similar characteristics for all metallic materials. Thus, corrosion on stainless steel (including CASS) or nickel-alloy surfaces will look similar to corrosion on carbon steel surfaces. Since the applicant proposes to perform visual inspection of external surfaces for corrosion, the staff finds that the aging effect of loss of material in the external stainless steel and CASS tubing and valve body and nickel-alloy piping and hosing surfaces that are exposed to outdoor will be adequately managed by using the External Surface Monitoring Program. RAI 3.3.2.14-1 is resolved.

In LRA Table 3.3.2-30, the applicant proposed to manage loss of material of the gray cast iron piping exposed to condensation – external, using the Selective Leaching of Materials Inspection Program (B.2.36). The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.2.12. Condenstation – external is not an environment covered in the GALL Report. However, there are similar environments covered in the GALL Report for gray cast iron where loss of material is the aging effect requiring management and Selective Leaching of Materials (XI.M33) is the AMP. Because the environment, condensation - external, is similar to environments listed in the GALL Report, such as treated water, raw water, and closed cycle cooling water, the staff finds that this line item is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.31 Solid Waste Disposal System - Summary of Aging Management Evaluation – LRA Table 3.3.2-31

The staff reviewed LRA Table 3.3.2-31, which summarizes the results of AMR evaluations for the solid waste disposal system component groups.

In this LRA table Table 3.3.2-31, the applicant proposed for these systems that sight glass exposed to air with borated water leakage-external would have no aging effect requiring management and, there would be no aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In LRA Table 3.3.2-31 the applicant proposed to manage loss of material of stainless steel filter housings, piping, pump casings, tanks, and tubing exposed to raw water using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During its review, the staff noted that the applicant applied Note E to these items and provided clarification by plant-specific Note 316. The staff reviewed the AMR results lines that reference Note E and determined that the component type, material, and environment are consistent with the GALL Report which recommends the Open-Cycle Cooling Water System Program (XI.M20).

The staff reviewed plant-specific Note 316 which states that this raw water environment is associated with aerated drains from sumps and that the Open Cycle Cooling Water System Program is not applicable to this environment. The Open Cycle Cooling Water System Program was reviewed by the staff in SER Section 3.0.3.1.19. The staff noted that the applicant's proposed program would be effective in monitoring and detecting this aging effect because it would perform visual inspections of the internal surfaces of piping, pump casings, tanks, and tubing during the performance of maintenance activities when they are made accessible. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. On this basis, the staff finds that this aging effect will be adequately managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.3.2-31, the applicant proposed to manage cracking of the elastomeric flexible hoses exposed to indoor uncontrolled air-EXT and indoor uncontrolled air environment using the External Surface Monitoring Program.

Assessment of Applicable Aging Effects. The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F.

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.

The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21, 2008, the applicant explained, that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable

basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components, and because this meets the staff's LRA screening basis in 10 CFR 54.21(a)(1)(ii), that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, "wear" is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that as such, loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluate the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear. The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant's basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking. The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of "change in material properties." The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, Volume 2), Section IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms," the staff groups "weathering" as an aging mechanism within the scope of the grouping "Elastomer degradation," and defines "weathering" as "Degradation of external surfaces of materials when exposed to outside environment." The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, do not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant's UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicants response and finds that, chemical degradation of elastomer components in contact with a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated

“short-lived.” On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), “short-lived” components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect “wear” is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant’s review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant’s response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

<u>Assessment of the Applicant’s Aging Management Programs or Activities Credited for Aging Management</u>. The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of flexible connection exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant’s External Surfaces Monitoring Program is GALL AMP XI.M36, “External Surfaces Monitoring.” The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, “External Surfaces Monitoring,” is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, “External Surfaces Monitoring,” does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, “External Surfaces Monitoring,” does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant’s program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing cracking. The applicant’s program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in: (1) the elastomeric auxiliary system components that are exposed, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed externally to uncontrolled indoor air.

In its response dated July 21, 2008, the applicant explained that, as identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the replacement activities will be determined based upon manufacturer recommendations and operating experience, and that the flexible hoses (non-flexible ventilation connection components) in the auxiliary feedwater system are, therefore, classified as short-lived and excluded from aging management review. The staff's basis for concluding that the non-flexible ventilation connection components in the auxiliary systems do not need to be subject to an AMR or to any AMPs for aging management has been discussed previously in the *Assessment of Applicable Aging Effects* portion of this evaluation.

In regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, "External Surfaces Monitoring. The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers in noticed (such as a change in strength or hardness of the material).

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss of strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surfaces Monitoring Program. The External Surfaces Monitoring Program will be representative of the conditions on the internal

surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant’s letter of July 21, 2008. Based on the applicant’s response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant’s augmentation of its External Surfaces Monitoring Program, the staff concludes that the applicant has resolved the staff’s concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff’s concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

<u>Conclusion</u>. On the basis of its review the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-31, the applicant states that elastomeric flexible hose exposed to air with borated water leakage-EXT experiences no aging effect requiring management, and therefore does not require an aging management program.

<u>Staff Evaluation</u>

<u>*Assessment*</u>. The staff reviewed the applicant’s plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff’s evaluation of the applicant’s identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

The staff reviewed the applicant's AMRs for the component-elastomer-environment combinations listed in Table 3.3.2.3-2 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for: (1) the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed to either lubricating oil or externally to an borated water leakage environment. The component-elastomer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI 3.3.2.3-3/3.4.2.3-3 to request identification of the specific elastomeric materials that were used in fabrication of the elastomeric components listed in these auxiliary AMR items (and for the flexible hoses in the auxiliary feedwater systems) and to provide a more detailed technical basis on whether there are any AERMs for the component-elastomer material-environment combinations in these AMRs.

The applicant responded to RAI 3.3.2.3-3/3.4.2.3-3 in a letter dated July 21, 2008. In its response, the applicant stated that BVPS LRA is revised to include a new License Renewal Future Commitment to address elastomeric components. The applicant clarified that with the exception of elastomeric flexible ventilation connection components in the control area and plant are ventilation systems, the applicant will perform repetitive maintenance tasks and periodic replacement of the elastomeric components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 prior to the period of extended operation, such that the components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii). The applicant also identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience. The staff noted that replacing these elastomeric components on a frequency that is consistent with the vendor recommendations provides an acceptable basis for replacing these components on a specified qualified life. The staff verified that, in the applicant's letter of July 21, 2008, the applicant appropriately amended the LRA to delete the AMRs for these components from the scope of the LRA and to instead amend the application to incorporate these components into a periodic replacement program under LRA Commitment No. 21 in UFSAR Supplement Table A.4-1 for Unit and Commitment No. 23 in UFSAR Supplement Table A.5-1 for Unit 2. Thus, based on this review, the staff finds this to be an acceptable basis for not including these elastomeric components within the scope of an AMR because the components will be replaced on a specified qualified life for the components such that the components are not required to be subject to an aging management review in accordance with the requirements of 10 CFR 54.21(a)(1)(i) and (ii).

For the elastomeric flexible connection components in the control area and plant area ventilation systems (i.e. flexible ventilation connection components) the applicant explained that the components will remain categorized as "long-lived" and will remain subject to aging management review. For these components, with respect to the applicant's response to RAI 3.3.2.3-3/3.4.2.3-3, Part 1, the applicant clarified that the elastomeric flexible ventilation connection components are fabricated of fiberglass, with double coated with neoprene (polychloroprene) on the internal and external fiberglass surfaces. The staff reviewed the applicant's response to 3.3.2.3-3/3.4.2.3-3, Part 1, and finds that it adequately resolved the question raised in the RAI because the response clearly identified the elastomeric material that was used in the fabrication of the elastomeric components mentioned in these plant-specific AMR items. RAI 3.3.2.3-3/3.4.2.3-3, Part 1, is resolved.

In its response to RAI 3.3.2.3-3/3.4.2.3-3,, Parts 2 and 3, the applicant stated that according to the EPRI Structural Tools, Section 7.1.1:

> “Neoprene is chemically and structurally similar to natural rubber, and its mechanical properties are also similar. This resistance to oils, chemicals, sunlight, weathering, aging and ozone is outstanding. It retains its properties at temperatures up to 250°F.”

The applicant further explained that the EPRI Structural Tools identifies various changes in elastomer properties that corresponded to the aging effects identified as “cracking” and as “hardening and loss of strength” in the GALL Report, and that the environmental conditions that might result in these aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant clarified that neoprene is relatively insensitive to temperature, ozone, and ultraviolet and ionizing radiation exposure, but the potential for the GALL Report aging effects of “cracking and “hardening and loss of strength” was not excluded for neoprene aging evaluations. The applicant explained that it assigned both “Air-indoor uncontrolled” and “Air with borated water leakage” environments to in-scope components in areas containing borated water systems. Where the external environment of “Air with borated water leakage’ exists, the environment of “Air-indoor uncontrolled” is also evaluated. However, the applicant clarified that the presence of boric acid leakage does not result in additional aging effects for elastomers in general or neoprene specifically, and that as a result of these determination, no additional aging effects were identified for the neoprene surfaces that are associated specifically with an air with borated water leakage environment.

The staff noted that the aging effects identified by the applicant for these elastomeric flexible ventilation connection components were consistent with the aging effects for elastomeric components listed in Section VII of the GALL Report, Volume 2. Based on this review, the staff finds that it adequately resolved the staff’s inquiry on the aging effects that are applicable to these elastomeric components because the applicant has identified cracking and changes in the hardness or strength properties are the aging effects requiring management for the surfaces that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water and because the staff has verified that this is in conformance with the applicable aging effects that are listed for elastomeric components in the AMRs of Section VII of the GALL Report, Volume 2.

The staff noted that for the elastomeric flexible ventilation connection components in the BVPS control area and plant area ventilation systems, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in hardness or strength of the elastomeric flexible ventilation connection components. The staff also noted, that in the applicant’s response to RAI 3.3.2.3-2/3.4.2.3-2, dated July 21, 2008, the applicant clarified that the visual examinations of these flexible ventilation connection components would be supplemented by physical manipulations of the components in order to aid with the identification of cracking or any changes in the hardness or strength properties of the components.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed

or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests of these elastomeric components in the applicant's letter of July 21, 2008. Based on the applicant's response to RAI s 3.3.2.3-2/3.4.2.3-2 and 3.3.2.3-3/3.4.2.3-3 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that applicant has resolved the staff's concerns and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing cracking in the components or any significant changes in the hardness or strength properties of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concerns in RAI 3.3.2.3-2/3.4.2.3-2 and RAI 3.3.2.3-3/3.4.2.3-3 are resolved.

Conclusion. On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-31, the applicant states that polymeric tanks exposed to indoor uncontrolled air, treated water, indoor uncontrolled air-EXT, and air with borated water leakage-EXT experience no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

Assessment of the Applicant's Identification of Aging Effects. The staff reviewed the applicant's AMRs for the component-polymer-environment combinations listed in Table 3.3.2.3-3 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for the polymer auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water. The component-polymer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2.3-2 above. The staff issued RAI 3.3.2.3-4 to request identification of the specific polymer materials that were used in fabrication of the components listed in these auxiliary system AMR items and to provide a more detailed technical basis on whether there are any AERMs for the component-polymer material-environment combinations in these AMRs.

In its letter dated July 21, 2008, the applicant explained that it has reviewed details associated with the various polymer components addressed in the LRA. The applicant stated that Polymer hoses in the Halon fire protection subsystems are periodically tested and replaced on condition, and, therefore, are considered consumables as described in LRA Section 2.1.2.4.3.

The applicant stated that the BVPS LRA is revised to include a new License Renewal Future Commitment to address the remaining polymer components. The applicant explained that specifically, with the exception noted in this response, it will perform repetitive maintenance tasks prior to the period of extended operation, to periodically replace, or to periodically test and replace on condition, polymer components identified in LRA Sections 3.1, 3.2, 3.3 and 3.4 such that those components are classified as "short-lived" and not subject to aging management, per 10 CFR 54.21 (a)(1)(ii). The applicant identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience.
The applicant stated that the exception to testing/replacement of polymers by preventive maintenance is GeoFlex®-D piping used as the buried fuel oil piping in the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems.

The applicant stated that the LRA is further revised to delete, as appropriate, the polymer component types, materials and aging effects from the LRA Table 2's and the summary lists of materials and environments in LRA Sections 3.1, 3.2, 3.3 and 3.4. The applicant referred to the Enclosure to this letter for the revision to the BVPS LRA.

In response to the first part of this RAI, which asks the identity of the polymeric material from which the polymer subject to AMR is manufactured, the applicant states that the GeoFlex®-D piping is a double-walled, flexible piping system designed for direct burial and that GeoFlex® pipe is a totally-bonded, multi-layer composite construction with braided fiber reinforcement. The applicant further explained that the inner-most Kynar® (polyvinylidene fluoride) barrier layer is impermeable to diesel fuel and that the exterior has a nylon barrier layer to protect the outer wall from chemical and microbial attack. The applicant also stated that additional intermediate layers are made of polyethylene and nylon.

In response to the second part of this RAI, which asks whether the polymer is elastomeric, thermoplastic, or thermoset material in order to identify their age-related degradation mechanisms, the applicant stated that Kynar®, nylon and polyethylene are thermoplastics. The applicant further stated that it used the EPRI Mechanical Tools to determine that polymers, such as those used in GeoFlex® piping, are either completely resistant to the fluid environment, or they deteriorate. Further the applicant stated that unlike metals, plastics do not display corrosion rates. The applicant explained that rather than depending upon an oxide layer for protection, plastics depend upon chemical resistance to the environment to which they are exposed. The applicant further explained that acceptability for the use of plastics within a given environment is a design-driven criterion; once the appropriate material is chosen, the system will have no aging effects due to exposure to the contained fluid however, chemical decomposition due to exposure to ozone and ultraviolet or ionizing radiation is a potential aging effect for some polymers.

In response to the third part of this RAI, which asks about the particular environment to which each polymer subject to AMR is exposed and its AERMs, the applicant stated that the materials of construction of GeoFlex® piping were specifically chosen for use in transporting fuel oils and for direct burial. The applicant identified that the product is Underwriters Laboratories (UL) listed for this application. Further, the applicant stated that the soil environment precludes exposure to ozone and to ultraviolet and ionizing radiation. The applicant referenced an April 22, 1997, U.S. Environmental Protection Agency Memo (from Anna Hopkins Virbick, Director, Office of Underground Storage Tanks, to Environmental Protection Agency UST/LUST Regional Program Managers and State UST Program Managers - Subject: Transmittal of Survey of Flexible Piping Systems) transmitted the results of a survey of flexible piping used in underground fuel oil delivery systems, and included evaluation of GeoFlex® operating experience. The applicant stated that the survey concluded that problems with the systems have been infrequent, and the performance of the technology has been excellent.

The applicant concluded that based on this review of industry operating experience and the use of proper design and application of the material, GeoFlex® piping materials with internal fuel oil and external buried (soil) environments do not exhibit aging effects requiring management.

The staff reviewed the applicant's response to RAI 3.3.2.3-4 and its revised LRA which includes a new License Renewal Future Commitment to address the polymer components subject to AMR, and finds that it adequately explains that with the exception of the underground fuel oil piping servicing the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems, all the polymeric material previously described in the LRA Table 2's are now designated as short-lived. The staff further evaluated the applicant's explanation that the short-lived polymeric components will be subject to periodic testing and replacement activities based on manufacturer's recommendations and operating experience. The staff also evaluated the applicant's response concerning Halon system fire hoses and finds that they are consumable items under LRA Section 2.1.2.4.3.

The staff reviewed the applicant's explanation of the fuel oil piping to the Security Diesel Generator System and the Emergency Response Facility Substation System diesel generator fuel oil systems which it identified as GeoFlex® D. The staff finds that this material is a polymer similar to polymers used in other nuclear plant applications such as fiberglass and PVC and therefore, will not result in aging that will be of concern during the period of extended operation and that because the piping was designed for direct burial, there are no AERMs requiring management. Therefore, the staff's concern in RAI 3.3.2.3-4 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.32 Supplementary Leak Collection and Release System - Summary of Aging Management Evaluation – LRA Table 3.3.2-32

The staff reviewed LRA Table 3.3.2-32, which summarizes the results of AMR evaluations for the supplementary leak collection and release system component groups.

In LRA Table 3.3.2-32, the applicant proposed to manage cracking of the elastomeric flexible connections exposed to indoor uncontrolled air-EXT and indoor uncontrolled air environments using the External Surface Monitoring Program.

Assessment of Applicable Aging Effects. The staff reviewed the applicant's plant-specific AMRs on cracking of the elastomeric flexible connections components that are exposed to uncontrolled indoor air against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the paragraphs that follow.

The staff verified that the applicant's identification of cracking (including that induced by crazing or fatigue breakdown) as an applicable AERM for these components was consistent with criteria for elastomeric degradation in GALL Volume 2 Table IX.F. Based on this review the staff finds that the applicant's identification that cracking is an applicable AERM for these components is acceptable because it is in conformance with GALL Volume 2 Table IX.F.

The staff noted that the applicant did not identify loss of material due to wear (including wear induced by abrasion) or chemical decomposition (including that induced by chemical attacks or weathering) as AERMs for the elastomeric auxiliary components that are exposed, either internally or externally, to uncontrolled indoor air or dry air.

The staff issued RAI 3.3.2.3-1/3.4.2.3-1 to the applicant and asked the applicant to justify its basis for concluding that loss of material due to wear (including wear induced by abrasion) or chemical reaction/decomposition (including that induced by chemical attacks or weathering) are not AERMs for each elastomeric auxiliary component that is exposed, either internally or externally, to uncontrolled indoor air or dry air.

In its letter dated July 21, 2008, the applicant explained, that the potential for chemical degradation of elastomers (other than by exposure to oxygen or ozone) is limited to applications in which the component contains a liquid or gas other than air. As identified in the response to RAI 3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the repetitive replacement tasks will be determined based upon manufacturer recommendations and operating experience, and as a result of replacement on this specified frequency, the flexible hoses in the auxiliary feedwater system are classified as short-lived and excluded from aging management review. The applicant explained that the remainder of this response is applicable to the management of aging in the elastomeric flexible ventilation connections. The staff finds that this is an acceptable

basis for removing the non-flexible ventilation connection components from the scope of an AMR because the components will be replaced on a specified frequency that is based on the vendor recommendations for these components and because this meets that staff's LRA screening basis in 10 CFR 54.21(a)(1)(ii) that components that are replaced on a specified time frequency or qualified life need not be included within the scope of an AMR.

The applicant explained that it used the EPRI Mechanical Tools and Structural Tools, supplemented by operating experience reviews, as the primary references to identify potential aging effects for material-environment combinations. In the EPRI Tools, "wear" is evaluated as a design consideration, rather than an aging effect. The applicant stated that instances of significant wear or fretting are not related to normal aging, and are expected to manifest well before the period of extended operation and be corrected, and that as such, loss of material due to wear or fretting from normal plant operations is expected to be insufficient and is not expected to result in loss of component function during the period of extended operation. The applicant stated that EPRI Tools does not specifically consider loss of material due to wear or abrasion to be applicable aging mechanisms for internal or external surfaces of elastomers, but does recommend that LRA applicants evaluated the potential for loss of material to occur in their elastomeric flexible ventilation components as a result of wear.

The applicant stated that its review of plant-specific operating experience did not identify any elastomeric flexible ventilation connection components for which loss of material due to wear was determined to be an additional aging effect that required management.

The staff was of the opinion that the applicant's basis for concluding that wear is not applicable for the elastomeric flexible ventilation connections would only be valid if the surfaces of these elastomeric components are not subject to motion against a harder solid surface or against a viscous liquid. However, the applicant does credit visual examinations of the elastomeric flexible ventilation components for cracking. The staff noted however that the visual examinations performed on these elastomeric components will be capable of detecting any loss of material that may occur in the components as a result of abrasion or wear and thus are sufficient to detect any wear that could potentially occur in the components.

In regard to assessing whether the applicant needs to address weathering of the elastomeric flexible ventilation connections, the staff noted in EPRI Tools, weathering of elastomers is addressed as an aging mechanism that is encompassed within the aging effect of "change in material properties." The staff also noted that in GALL Report (i.e., NUREG-1801, Revision 1, Volume 2), Section IX.F, "Selected Definitions and Use of Terms for Describing and Standardizing Aging Mechanisms," the staff groups "weathering" as an aging mechanism within the scope of the grouping "Elastomer degradation," and defines "weathering" as "Degradation of external surfaces of materials when exposed to outside environment." The staff verified that the BVPS LRA, Sections 3.1, 3.2, 3.3 and 3.4, do not identify any in-scope elastomer components that are subject to an uncontrolled, air-outdoor environment and that this is supported by the information in the plant's UFSAR. Therefore, based on this review, the staff concludes that the applicant has provided an acceptable basis that it does not need to consider weathering of the elastomeric flexible ventilation connections because the staff has verified that these components are not subjected to an uncontrolled, outdoor air environment.

The staff reviewed the applicants response and finds that, chemical degradation of elastomer components in contact with a liquid or gas other than air, repetitive maintenance tasks will be performed prior to the period of extended operation and that these components are designated "short-lived." On the basis that, in accordance with 10 CFR 54.21(a)(1)(2), "short-lived" components are not subject to an AMR, the staff finds this acceptable.

The staff also finds that the applicant adequately explains that the aging effect "wear" is a design consideration and that suitable elastomeric materials are utilized in components subject to an AMR. The staff finds that the applicant's review of plant-specific operating experience that did not identify any elastomeric components for which loss of material due to wear, adequately explains that wear is not an aging effect at BVPS.

The staff reviewed the applicant's response pertaining to weathering and finds that it adequately explains that it has identified no elastomeric components in an air-outdoor environment and is therefore not applicable to BVPS.

<u>Assessment of the Applicant's Aging Management Programs or Activities Credited for Aging Management</u>. The staff noted that the applicant credits its External Surfaces Monitoring Program to manage the cracking of flexible connection exposed to indoor uncontrolled air. The AMP in the GALL Report that corresponds to the applicant's External Surfaces Monitoring Program is GALL AMP XI.M36, "External Surfaces Monitoring." The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, "External Surfaces Monitoring," is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, "External Surfaces Monitoring," does not apply to elastomeric components or to the management of cracking in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage cracking in these elastomeric seals or components:

(1) The scope of the GALL AMP XI.M36, "External Surfaces Monitoring," does not include elastomeric components nor does it apply to the management of cracking or changes in material properties that may occur in elastomeric components.

(2) The applicant's program credits only visual examinations of the external seal surfaces as its basis for managing cracking in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 credit only VT-1 visual examination techniques as being acceptable inspection techniques for managing cracking. The applicant's program did not: (1) specify whether the visual examination techniques for cracking would be enhanced VT-1 techniques, or (2) explain how a visual examination of the external surface could be capable of detecting a subsurface crack or a crack that only penetrated the internal surface of the component.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 to the applicant and asked the applicant to justify its basis for crediting the External Surfaces Monitoring Program for management of cracking in: (1) the elastomeric auxiliary system components that are exposed, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed externally to uncontrolled indoor air.

In its response dated July 21, 2008, the applicant explained that, as identified in the response to RAI-3.3.2.3-3/3.4.2.3-3, (with the exception of elastomeric flexible ventilation connections), the applicant stated that it will perform repetitive maintenance tasks prior to the period of extended operation, to replace the elastomeric non-flexible ventilation connection components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 such that those components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii).

The applicant further explained that the frequency of the replacement activities will be determined based upon manufacturer recommendations and operating experience, and that the flexible hoses (non-flexible ventilation connection components) in the auxiliary feedwater system are, therefore, classified as short-lived and excluded from aging management review. The staff's basis for concluding that the non-flexible ventilation connection components in the auxiliary systems do not need be subject to an AMR or to any AMPs for aging management has been discussed previously in the *Assessment of Applicable Aging Effects* portion of this evaluation.

In regard to aging management of the elastomeric flexible ventilation connection components, which are the only remaining elastomeric components subject to aging management, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in material properties of the components. The applicant stated that the External Surfaces Monitoring Program implements the recommended aging management program elements described in GALL AMP XI.M36, "External Surfaces Monitoring." The applicant stated that, in addition to the normal visual examinations that this AMP implements for the external component surfaces, the program also includes additional physical activities that are beyond the scope of the GALL AMP XI.M36 recommendations to ensure that any cracking in the elastomers will be noticed or that any change in the material properties of the elastomers is noticed (such as a change in strength or hardness of the material)

The applicant stated that the program elements of its AMP are being augmented to include physical manipulation of elastomeric components that will flex the material. The applicant clarified that these flexible ventilation connections can be pinched or pushed to create a bend, and that such physical manipulation can be used to assist the visual examinations of the program in detecting whether cracks are present in elastomeric surface (i.e., any surface breaking cracks will open on the outer radius of the bend and become more visible as the outer surface stretches to accommodate the bend) or to detect whether the elastomer is hardening or loss strength.

The applicant also clarified that aging of the internal surfaces of elastomers in ventilation systems is similar to that of the external surfaces, and that the environmental conditions that result in elastomer aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant stated that the external surfaces are more likely to be exposed to ultraviolet radiation than internal surfaces, are equally likely to be exposed to oxygen, and ozone, and that temperature and ionizing radiation will affect the internal and external surfaces similarly. Therefore, the based on these bases, the applicant provided its basis for concluding that the condition of the external elastomeric surfaces are expected to be representative of the conditions on the component internal surfaces, and that visual inspections and physical manipulations performed under the External Surfaces Monitoring Program. The External Surfaces Monitoring Program will be representative of the conditions on the internal

surfaces and will provide reasonable assurance that aging effects of elastomeric components will be identified and managed prior to loss of ventilation system function.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed for the detection of cracking or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests in the applicant's letter of July 21, 2008. Based on the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that the applicant has resolved the staff's concern and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing the presence of any cracking in the components or any significant changes in the hardness or strength of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concern in RAI 3.3.2.3-2/3.4.2.3-2 is resolved.

Conclusion. On the basis of its review the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.3.2-32, the applicant states that elastomeric flexible connection exposed to air with borated water leakage-EXT experiences no aging effect requiring management, and therefore does not require an aging management program.

Staff Evaluation

Assessment. The staff reviewed the applicant's plant-specific AMRs for the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water against the criteria summarized in this evaluation. The staff's evaluation of the applicant's identification of aging effects and proposed aging management program are given in the subsections to this Staff Evaluation.

The staff reviewed the applicant's AMRs for the component-elastomer-environment combinations listed in Table 3.3.2-32 above against the staff's criteria that have been summarized in this section. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for: (1) the elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water, and (2) the elastomeric flexible hoses in the auxiliary feedwater systems that are exposed to either lubricating oil or externally to a borated water leakage environment. The component-elastomer-environment combinations for the applicable auxiliary system AMRs have been listed in Table 3.3.2-32 above. The staff issued RAI 3.3.2.3-3/3.4.2.3-3 to request identification of the specific elastomeric materials that were used in fabrication of the elastomeric components listed in these auxiliary AMR items (and for the flexible hoses in the auxiliary feedwater systems), and to provide a more detailed technical basis on whether there are any AERMs for the component-elastomer material-environment combinations in these AMRs.

The applicant responded to RAI 3.3.2.3-3/3.4.2.3-3 in a letter dated July 21, 2008. In its response, the applicant stated that BVPS LRA is revised to include a new License Renewal Future Commitment to address elastomeric components. The applicant clarified that with the exception of elastomeric flexible ventilation connection components in the control area and plant are ventilation systems, the applicant will perform repetitive maintenance tasks and periodic replacement of the elastomeric components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 prior to the period of extended operation, such that the components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii). The applicant also identified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience. The staff noted that replacing these elastomeric components on a frequency that is consistent with the vendor recommendations provides an acceptable basis for replacing these components on a specified qualified life. The staff verified that, in the applicant's letter of July 21, 2008, the applicant appropriately amended the LRA to delete the AMRs for these components from the scope of the LRA and to instead amend the application to incorporate these components into a periodic replacement program under LRA Commitment No. 21 in UFSAR Supplement Table A.4-1 for Unit and Commitment No. 23 in UFSAR Supplement Table A.5-1 for Unit 2. Thus, based on this review, the staff finds this to be an acceptable basis for not including these elastomeric components within the scope of an AMR because the components will be replaced on a specified qualified life for the components such that the components are not required to be subject to an aging management review in accordance with the requirements of 10 CFR 54.21(a)(1)(i) and (ii).

For the elastomeric flexible connection components in the control area and plant area ventilation systems (i.e. flexible ventilation connection components) the applicant explained that the components will remain categorized as "long-lived" and will remain subject to aging management review. For these components, with respect to the applicant's response to RAI 3.3.2.3-3/3.4.2.3-3, Part 1, the applicant clarified that the elastomeric flexible ventilation connection components are fabricated of fiberglass, with double coated with neoprene (polychloroprene) on the internal and external fiberglass surfaces. The staff reviewed the applicant's response to 3.3.2.3-3/3.4.2.3-3, Part 1, and finds that it adequately resolved the question raised in the RAI because the response clearly identified the elastomeric material that was used in the fabrication of the elastomeric components mentioned in these plant-specific AMR items. RAI 3.3.2.3-3/3.4.2.3-3, Part 1 is resolved.

In its response to RAI 3.3.2.3-3/3.4.2.3-3, Parts 2 and 3, the applicant stated that according to the EPRI Structural Tools, Section 7.1.1:

> "Neoprene is chemically and structurally similar to natural rubber, and its mechanical properties are also similar. This resistance to oils, chemicals, sunlight, weathering, aging and ozone is outstanding. It retains its properties at temperatures up to 250°F."

The applicant further explained that the EPRI Structural Tools identifies various changes in elastomer properties that corresponded to the aging effects identified as "cracking" and as "hardening and loss of strength" in the GALL Report, and that the environmental conditions that might result in these aging effects are related to temperature, ozone, and ultraviolet or ionizing radiation exposure. The applicant clarified that neoprene is relatively insensitive to temperature, ozone, and ultraviolet and ionizing radiation exposure, but the potential for the GALL Report aging effects of "cracking and "hardening and loss of strength" was not excluded for neoprene aging evaluations. The applicant explained that it assigned both "Air-indoor uncontrolled" and "Air with borated water leakage" environments to in-scope components in areas containing borated water systems. Where the external environment of "Air with borated water leakage" exists, the environment of "Air-indoor uncontrolled" is also evaluated. However, the applicant clarified that the presence of boric acid leakage does not result in additional aging effects for elastomers in general or neoprene specifically, and that as a result of these determination, no additional aging effects were identified for the neoprene surfaces that are associated specifically with an air with borated water leakage environment.

The staff noted that the aging effects identified by the applicant for these elastomeric flexible ventilation connection components were consistent with the aging effects for elastomeric components listed in Section VII of the GALL Report, Volume 2. Based on this review, the staff finds that it adequately resolved the staff's inquiry on the aging effects that are applicable to these elastomeric components because the applicant has identified cracking and changes in the hardness or strength properties are the aging effects requiring management for the surfaces that are exposed to either an external air with borated water leakage environment or to fuel oil, lubricating oil, or closed-cycle cooling water and because the staff has verified that this is in conformance with the applicable aging effects that are listed for elastomeric components in the AMRs of Section VII of the GALL Report, Volume 2.

The staff noted that for the elastomeric flexible ventilation connection components in the BVPS control area and plant area ventilation systems, the applicant credited its External Surfaces Monitoring Program to manage cracking and changes in hardness or strength of the elastomeric flexible ventilation connection components. The staff also noted, that in the applicant's response to RAI 3.3.2.3-2/3.4.2.3-2, dated July 21, 2008, the applicant clarified that the visual examinations of these flexible ventilation connection components would be supplemented by physical manipulations of the components in order to aid with the identification of cracking or any changes in the hardness or strength properties of the components.

The staff issued RAI 3.3.2.3-2/3.4.2.3-2 because the staff noted that a visual examination by itself might not be capable of demonstrating the presence of a tight cracking in the elastomeric material and because a visual examination alone would not be capable of detecting a change in material properties (i.e., a change in the elastomer strength or hardness). Thus, for cracking, the staff was of the opinion that either a different inspection technique would need to be proposed

or that some physical test would need to be coupled to the visual examinations in order to assist them in revealing the presence of tightly configure cracks in the elastomeric materials. The staff was also of the opinion that a change in the hardness or strength of the elastomers would either need to be analyzed for or tested for by a physical test.

The staff verified that the applicant made the applicable augmentation of the program elements in the External Surfaces Monitoring Program to include the additional physical manipulation tests of these elastomeric components in the applicant's letter of July 21, 2008. Based on the applicant's response to RAIs 3.3.2.3-2/3.4.2.3-2 and 3.3.2.3-3/3.4.2.3-3 and the applicant's augmentation of its External Surfaces Monitoring Program, the staff concludes that the applicant has resolved the staff's concerns and that the updated, augmented AMP basis provides an acceptable basis for managing cracking and changes in material properties in the elastomeric flexible ventilation components because the augmentation of the AMP to couple the programs visual examinations with the additional physical manipulations will be capable of assisting the visual examinations in revealing cracking in the components or any significant changes in the hardness or strength properties of the materials (i.e., it will be hard to push in on the elastomers demonstrating a change in hardness, and it will be hard to bend them, demonstrating that the materials are losing their elasticity or are increasing in strength). The staff evaluation of the augmented External Surfaces Monitoring Program is given in SER Section 3.0.3.1.9. The staff's concerns in RAI 3.3.2.3-2/3.4.2.3-2 and RAI 3.3.2.3-3/3.4.2.3-3 are resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4 Aging Management of Steam and Power Conversion Systems

This Section of the SER documents the staff's review of the applicant's AMR results for the steam and power conversion systems components and component groups of:

- auxiliary feedwater system
- auxiliary steam system
- building services hot water heating system
- condensate system (Unit 1 only)
- glycol heating system (Unit 1 only)
- main feedwater system
- main steam system
- main turbine and condenser system

- steam generator blowdown system
- water treatment system

3.4.1 Summary of Technical Information in the Application

LRA Section 3.4 provides AMR results for the steam and power conversion systems components and component groups. LRA Table 3.4.1, “Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 for Steam and Power Conversion Systems,” is a summary comparison of the applicant’s AMRs with those evaluated in the GALL Report for the steam and power conversion systems components and component groups.

The applicant’s AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant’s review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.4.2 Staff Evaluation

The staff reviewed LRA Section 3.4 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion systems components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of 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 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 3.4.2.1.

In the onsite audit, the staff also 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 3.4.2.2 acceptance criteria. The staff’s audit evaluations are documented in SER Section 3.4.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff’s evaluations are documented in SER Section 3.4.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant’s operating experience to verify the applicant’s claims.

Table 3.4-1 summarizes the staff’s evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.4 and addressed in the GALL Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion Systems Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel piping, piping components, and piping elements exposed to steam or treated water (3.4.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes	TLAA	Fatigue is a TLAA (See SER Section 3.4.2.2.1)
Steel piping, piping components, and piping elements exposed to steam (3.4.1-2)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not Applicable to BVPS (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	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the 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	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the 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 3.4.2.2.2)
Steel and stainless steel tanks exposed to treated water (3.4.1-6)	Loss of material due to general (steel only) pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See SER Section 3.4.2.2.7.1)
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 (B.2.24) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See SER Section 3.4.2.2.2.2)

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
Steel piping, piping components, and piping elements exposed to raw water (3.4.1-8)	Loss of material due to general, pitting, crevice, and microbiologically -influenced corrosion, and fouling	Plant-specific	Yes	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report (See SER Section 3.4.2.2.3)
Stainless steel and copper alloy heat exchanger tubes exposed to treated water (3.4.1-9)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the 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 (B.2.24) and One-Time Inspection (B.2.30)	Consistent with the 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 microbiologically -influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	Yes	Buried Piping and Tanks Inspection (B.2.8) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (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 microbiologically -influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Not applicable	Not Applicable to BVPS (See SER Section 3.4.2.2.5.2)
Stainless steel piping, piping components, piping elements exposed to steam (3.4.1-13)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes	Not applicable	Not applicable to 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 > 60°C (> 140°F) (3.4.1-14)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See SER Section 3.4.2.2.6)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Aluminum and copper alloy piping, piping components, and piping elements exposed to treated water (3.4.1-15)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the 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	Water Chemistry (B.2.42) and One-Time Inspection (B.2.30)	Consistent with the 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	Buried Piping and Tanks Inspection (B.2.8) and One Time Inspection (B.2.30)	Consistent with the GALL Report (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 (B.2.24) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See SER Section 3.4.2.2.7.3)
Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil (3.4.1-19)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes	Lubricating Oil Analysis (B.2.24) and One-Time Inspection (B.2.30)	Consistent with the GALL Report (See SER Section 3.4.2.2.8)
Steel tanks exposed to air - outdoor (external) (3.4.1-20)	Loss of material, general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Not applicable	Not Applicable to BVPS (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)	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Bolting Integrity Program (B.2.6)	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 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 Program (B.2.6)	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water > 60°C (> 140°F) (3.4.1-23)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Not applicable	Not Applicable to BVPS (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	Closed-Cycle Cooling Water System (B.2.9)	Consistent with the GALL Report
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	Closed-Cycle Cooling Water System (B.2.9)	Consistent with the GALL Report
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 BVPS (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 BVPS (See SER Section 3.4.2.1.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Steel external surfaces exposed to air - indoor uncontrolled (external), condensation (external), or air outdoor (external) (3.4.1-28)	Loss of material due to general corrosion	External Surfaces Monitoring	No	External Surface Monitoring (B.2.15), and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report (See SER Section 3.4.2.1.2)
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 (B.2.18)	Consistent with GALL Report
Steel piping, piping components, and piping elements exposed to air outdoor (internal) or condensation (internal) (3.4.1-30)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report
Steel heat exchanger components exposed to raw water (3.4.1-31)	Loss of material due to general, pitting, crevice, galvanic, and microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Open-Cycle Cooling Water System (B.2.32)	Consistent with the GALL Report
Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water (3.4.1-32)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion	Open-Cycle Cooling Water System	No	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.22)	Consistent with GALL Report (See SER Section 3.4.2.1.4)
Stainless steel heat exchanger components exposed to raw water (3.4.1-33)	Loss of material due to pitting, crevice, and microbiologically -influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable	Not Applicable to BVPS (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, 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 BVPS (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 of Materials Inspection (B.2.36)	Consistent with the 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 of Materials Inspection (B.2.36)	Consistent with the GALL Report
Steel, stainless steel, and nickel-based alloy piping, piping components, and piping elements exposed to steam (3.4.1-37)	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Not applicable	Not Applicable to BVPS (See SER Section 3.4.2.1.1)
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 (B.2.7)	Consistent with GALL Report
Stainless steel piping, piping components, and piping elements exposed to steam (3.4.1-39)	Cracking due to stress corrosion cracking	Water Chemistry	No	Not applicable	Not Applicable to BVPS (See SER Section 3.4.2.1.1)
Glass piping elements exposed to air, lubricating oil, raw water, and treated water (3.4.1-40)	None	None	No	None	Consistent with the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Stainless steel, copper alloy, and nickel-alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.4.1-41)	None	None	No	None	Consistent with the GALL Report
Steel piping, piping components, and piping elements exposed to air - indoor controlled (external) (3.4.1-42)	None	None	No	Not applicable	Not Applicable to BVPS (See SER Section 3.4.2.1.1)
Steel and stainless steel piping, piping components, and piping elements in concrete (3.4.1-43)	None	None	No	Not applicable	Not Applicable to BVPS (See SER Section 3.4.2.1.1)
Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas (3.4.1-44)	None	None	No	None	Consistent with the GALL Report

The staff's review of the steam and power conversion systems component groups followed any one of several approaches. One approach, documented in SER Section 3.4.2.1, 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 3.4.2.2, 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 3.4.2.3, 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 steam and power conversion systems components is documented in SER Section 3.0.3.

3.4.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.4.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the steam and power conversion systems components:

- Bolting Integrity Program

- Boric Acid Corrosion Program
- Buried Piping and Tanks Inspection Program
- Closed-Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Open-Cycle Cooling Water System Program
- Selective Leaching of Materials Inspection Program
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- Water Chemistry Program

LRA Tables 3.4.2-1 through 3.4.2-10 summarizes AMRs for the steam and power conversion systems components and indicates AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency 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 line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and verified that the identified exceptions to the GALL 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 line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the 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 line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different

component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

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

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

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the engineered safety features ESF 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 3.2.1, 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 had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the subsections that follows.

3.4.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.4.1, item 20, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS AMR line items roll up to this item. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no steel tanks exposed outdoor air. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.4.1, items 23 and 26, the applicant states that the corresponding AMR result lines in the GALL Report is not applicable because no BVPS AMR line items roll up to these items. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that, within the Steam and Power Conversion systems, BVPS has no stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water (>60° (>140°F)) and that BVPS has no copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to BVPS.

In LRA Table 3.4.1, item 27, the applicant states that the corresponding AMR result line in the GALL Report is not applicable because no BVPS AMR line items roll up to this item. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that, within the Steam and Power Conversion systems, BVPS has no steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result line in the GALL Report is not applicable to BVPS.

In LRA Table 3.4.1, items 33 and 34, the applicant states that the corresponding AMR result lines in the GALL Report is not applicable because no BVPS AMR line items roll up to these items. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that, within the Steam and Power Conversion systems, BVPS has no stainless steel heat exchanger components exposed to raw water and that BVPS has no reinforced steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to BVPS.

In LRA Table 3.4.1, items 37 and 39, the applicant states that the corresponding AMR result lines in the GALL Report is not applicable because no BVPS AMR line items roll up to these items. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no steel, stainless steel, and nickel-based alloy piping, piping components, and piping elements exposed to steam and that BVPS has no stainless steel piping, piping components, and piping elements exposed to steam. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to BVPS.

In LRA Table 3.4.1, items 42 and 43, the applicant states that the corresponding AMR result lines in the GALL Report is not applicable because no BVPS AMR line items roll up to these items. The staff reviewed the documentation supporting the applicant's AMR evaluation and confirmed the applicant's claim that BVPS has no steel piping, piping components, and piping elements exposed to indoor controlled air and that BVPS has no steel, stainless piping, piping components, and piping elements in concrete. Therefore, the staff agrees with the applicant's determination that the corresponding AMR result lines in the GALL Report is not applicable to BVPS.

3.4.2.1.2 Loss of material due to General Corrosion in Uncontrolled Air Indoor Environments

In LRA Table 3.4.2-3, the applicant stated that loss of material of steel heating coil header exposed to air-indoor uncontrolled external environment is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that the applicant applied note E to these items. The applicant referenced Table 3.4-1, item 3.4.1-28 and GALL Report Volume 2, item VII.H-7. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M36, "External Surface Monitoring," the applicant proposed using the Internal Surfaces in Miscellaneous Piping and Ducting Components Program because for heating coil headers, the external surfaces may be within the ductwork.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspection, the staff finds the applicant’s use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to be acceptable.

3.4.2.1.3 Loss of Material Due to Pitting and Crevice Corrosion in Condensation Environments

In LRA Section 3.4 and in LRA Tables 3.4.2-9 and 3.4.2-10, the applicant provides its component-specific AMRs for managing loss of material in stainless steel steam and power conversion system components that are exposed to a condensation environment. The applicant identifies that these AMR items are applicable to the following systems and components:

- stainless steel tanks in the steam generator blowdown systems (Unit 2 only)
- stainless steel tanks in the water treatment systems

In these AMR items, the applicant identified that these steam and power conversion system (S&PC) AMR items are aligned to AMR 54 in Table 3 of the GALL Report, Unit 1, and to GALL AMR VII.D-4, which provide the GALL Reports recommendations for managing loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements of compressed air auxiliary systems under exposure to an internal condensation environment. For these AMRs, the applicant identifies that it credits its Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program to manage loss of material in the internal component surfaces that are exposed to the condensation environment.

In AMR item 54 in Table 3 of the GALL Report, Volume 1, and in AMR item VII.D-4 of the GALL Report, Volume 2, the staff identifies that loss of material due to pitting and crevice corrosion is an applicable aging effect requiring management (AERM) for stainless steel piping, piping components, and piping elements of compressed air auxiliary systems under exposure to an internal condensation environment. In these AMRs, the GALL Report recommends that the Compressed Air Monitoring Program be credited to manage loss of material due to pitting and crevice corrosion in the component surfaces that are exposed to a condensation environment.

The staff reviewed the information for the component specific AMRs in LRA Tables 3.4.2-9 and LRA 3.4.2-10 for the stainless steel tanks in the steam generator blowdown systems (Unit 2 only) and the stainless steel tanks in the water treatment systems against the staff’s recommendations in AMR item 54 in Table 3 of the GALL Report, Volume 1, and AMR item VII.D-4 of the GALL Report, Volume 2.

The staff verified that the applicant AMR analyses in these AMRs were consistent with the NRC recommendations in AMR item 54 in Table 3 of the GALL Report, Volume 1, and AMR item VII.D-4 of the GALL Report, Volume 2 with the exception that the applicant has credited its Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program to manage loss of material in the internal stainless steel tank surfaces that are exposed to the condensation environment. The staff also verified that the applicant includes its Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program in LRA Section B.2.22 and that the scope of this AMP consists "of inspections of the internal surfaces of piping, piping components, ducting and other components within the scope of license renewal that are not managed by other aging management programs," and that the AMP credits visual examinations of internal metal component surfaces to detect evidence of corrosion that may be indicative of loss of material in the components. The staff also verified that the applicant's LRA does not credit a Compressed Air Monitoring Program that is analogous to GALL AMP XI.M24, "Compressed Air Monitoring." Based on this review, the staff finds that the applicant's crediting of the Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program is an acceptable and valid alternative to the crediting of a Compressed Air Monitoring Program because the LRA does not include a Compressed Air Monitoring Program that is analogous to GALL AMP XI.M24, and because the Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program is a valid GALL-based AMP that is designed to detect indications of loss of material in the internal surfaces of miscellaneous metallic piping and ducting components.

The staff has noted that the applicant's LRA includes the following Footnote G based AMRs that pertain to the management of loss of material in the stainless steel components under exposure to a condensation environment:

- stainless steel tanks and valve bodies in the auxiliary feedwater system
- stainless steel tanks in the condensate system
- stainless steel piping and valve bodies in the main turbine and condenser system
- stainless steel piping and valve bodies in the water treatment system

The staff noted that the material-environment-aging effect combinations in the AMRs for these components and the AMP credited for management of loss of material in the components (i.e., the applicant's Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program) are identical to those in the Footnote E AMRs used to manage loss of material in those stainless steel steam generator blowdown system tanks (Unit 2 only) and stainless steel water treatment system tanks that are exposed to a condensation environment. Thus, the staff concluded that for these Footnote G based AMRs, the applicant could have been identified the AMRs as being consistent with GALL and aligned them to AMR item 54 in Table 3 of the GALL Report, Volume 1, and AMR item VII.D-4 of the GALL Report, Volume 2 under LRA Footnote E. Therefore, based on this assessment, the staff's evaluation given in this Section is also applicable to the evaluation of the Footnote G AMRs associated with the steam and power conversion system components listed in the bullets above, and based on this evaluation, the applicant has provided an acceptable basis for crediting its Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program to manage loss of material in the component surfaces that are exposed to a condensation environment. As a result, these AMRs do not need to be evaluated in Section 3.4.2.3 of the SER.

3.4.2.1.4 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion in Raw Water Environments

In LRA Table 3.4.2-10 the applicant proposed to manage loss of material of copper alloy <15% Zn piping and valve bodies exposed to raw water using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During its review, the staff noted that the applicant applied Note E to these items and provided clarification by plant-specific Note 412. The staff reviewed the AMR results lines that reference Note E and determined that the component type, material, and environment, are consistent with the GALL Report which recommends the Open-Cycle Cooling Water System Program (XI.M20).

The staff reviewed plant-specific Note 412, which states that this raw water environment is associated with filtered water from the Water Treatment System and that the Open Cycle Cooling Water System Program is not applicable to this environment. The Open Cycle Cooling Water System Program was reviewed by the staff in SER Section 3.0.3.1.19. The staff noted that the applicant's proposed program would be effective in monitoring and detecting this aging effect because it would perform visual inspections of the internal surfaces of piping and valve bodies during the performance of maintenance activities when they are made accessible. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. On this basis, the staff finds that this aging effect will be adequately managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.4.2-10 the applicant proposed to manage loss of material of stainless steel piping exposed to raw water using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During its review, the staff noted that the applicant applied Note E to these items and provided clarification by plant-specific Note 412. The staff reviewed the AMR results lines that reference Note E and determined that the component type, material, and environment are consistent with the GALL Report which recommends the Open-Cycle Cooling Water System Program (XI.M20).

The staff reviewed plant-specific Note 412, which states that this raw water environment is associated with filtered water from the Water Treatment System and that the Open Cycle Cooling Water System Program is not applicable to this environment. The Open Cycle Cooling Water System Program was reviewed by the staff in SER Section 3.0.3.1.19. The staff noted that the applicant's proposed program would be effective in monitoring and detecting this aging effect because it would perform visual inspections of the internal surfaces of piping during the performance of maintenance activities when they are made accessible. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. On this basis, the staff finds that this aging effect will be adequately managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.4.2-10 the applicant proposed to manage loss of material of steel piping exposed to raw water using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. During its review, the staff noted that the applicant applied Note E to these items and provided clarification by plant-specific Note 412. The staff reviewed the AMR results lines that reference Note E and determined that the component type, material, and environment are consistent with the GALL Report which recommends the Open-Cycle Cooling Water System Program (XI.M20).

The staff reviewed plant-specific Note 412, which states that this raw water environment is associated with filtered water from the Water Treatment System and that the Open Cycle Cooling Water System Program is not applicable to this environment. The Open Cycle Cooling Water System Program was reviewed by the staff in SER Section 3.0.3.1.19. The staff noted that the applicant's proposed program would be effective in monitoring and detecting this aging effect because it would perform visual inspections of the internal surfaces of piping during the performance of maintenance activities when they are made accessible. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. On this basis, the staff finds that this aging effect will be adequately managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.4.2-10, Water Treatment System, the applicant stated that loss of material for stainless steel and copper alloy piping, tubing and valve body exposed to raw water is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff noted that the applicant applied note E to these items. The applicant referenced Table 3.4-1, item 3.4.1-32 and GALL Report Volume 2, items VIII.E-18 and VIII.G-30. The staff reviewed the AMR results lines that reference note E and determines that the component type, material, environment, and aging effect are consistent with the GALL Report. However, the staff noted that where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. These components are in systems where the environment is filtered water and are not a part of the raw water systems where the aging effects are managed by the Open-Cycle Cooling Water System Program as part of GL 89-13 commitments.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components to which the applicant program is consistent, addresses only internal surfaces of steel piping, the aging mechanism of pitting or crevice corrosion show similar characteristics for all metallic materials and amenable to the same types of visual inspections. Thus, corrosion on stainless steel and copper alloy internal surfaces will look similar to corrosion on carbon steel surfaces. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to pitting and crevice corrosion in stainless steel and copper alloy piping, tubing and valve body exposed to raw water. On the basis that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program performs periodic visual inspection, the staff finds the applicant's use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program to be acceptable.

In LRA Section 3.4 and in LRA Table LRA 3.4.2-10, the applicant provides its component-specific AMR for managing loss of material due to pitting, crevice and micro-biologically influenced corrosion in the stainless steel piping, piping components, and piping elements of its water treatment systems as a result of exposing the internal component surfaces to a raw water environment. In this AMR line items, the applicant identified that this AMR item is aligned to AMR 32 in Table 4 of the GALL Report, Unit 1, and to GALL AMR VIII.G-30, and that it credits its Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program to manage loss of material in the internal component surfaces that are exposed to the raw water environment.

In AMR item 32 in Table 4 of the GALL Report, Volume 1, and in AMR item VIII.G-30 of the GALL Report, Volume 2, the staff identifies that loss of material due to pitting, crevice, and microbiologically-influence corrosion is an applicable aging effect requiring management (AERM) for those stainless steel piping, piping components, and piping elements of PWR auxiliary feedwater systems that are exposed to a raw water environment. In these AMRs, the GALL Report recommends that a program corresponding to GALL AMP XI.M20, "Open-Cycle Cooling Water System," be credited to manage loss of material due to pitting, crevice, and microbiologically-influence corrosion in the component surfaces that are exposed to a raw water environment.

The staff reviewed the information for the component specific AMR in LRA Table 3.4.2-10 for these stainless steel piping components in the water treatment systems against the staff's recommendations in AMR item 32 in Table 4 of the GALL Report, Volume 1, and AMR item VIII.G-30 of the GALL Report, Volume 2.

The staff verified that the applicant AMR analysis in this AMR is consistent with the NRC recommendations in AMR item 32 in Table 4 of the GALL Report, Volume 1, and AMR item VIII.G-30 of the GALL Report, Volume 2 with the exception that the applicant has extrapolated the GALL recommendations to the stainless steel piping in its water treatment systems that are exposed to a raw water environment and that the applicant has credited its Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program to manage loss of material in the component surfaces that are exposed to the raw water environment. The staff also verified that the applicant includes its Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program in LRA Section B.2.22 and that the scope of this AMP consists "of inspections of the internal surfaces of piping, piping components, ducting and other components within the scope of license renewal that are not managed by other aging management programs," and that the AMP credits visual examinations of internal metal component surfaces to detect evidence of corrosion that may be indicative of loss of material in the components.

The staff noted that the applicant identifies that LRA Table 3.4.2-10 AMR Footnote 412 is associated with this AMR and that in the footnote, the applicant identifies that the raw water environment associated with this components is filtered water associated with the water treatment system, and not the service water from the river that serves as the ultimate heat sink for the reactor units. Based on this determination, the staff concludes that AMP B.2.22, "Inspections of Internal Surfaces of Miscellaneous Piping and Ducting Program," is an acceptable alternative AMP for aging management of loss of material in these components because the raw water in contact with these components is not associated with the open-cycle cooling water from the ultimate heat sink for the plants, and because the Inspections of Internal

Surfaces of Miscellaneous Piping and Ducting Program is a valid GALL-based AMP that is designed to detect indications of loss of material in the internal surfaces of miscellaneous metallic piping and ducting components.

On the bases of its review of AMR item described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant has adequately addressed the aging management of loss of material due to pitting, crevice, and microbiologically-influenced corrosion in the stainless steel water treatment system piping components as a result of exposing the component surfaces to a filtered raw water environment.

3.4.2.1.5 Amended LRA Input for Loss of Material Due to General, Pitting, Crevice and Microbiologically-Influenced Corrosion and Fouling

By letter dated September 25, 2008, the applicant amended its LRA such that the AMP B.2.36 “Selective Leaching of Materials Inspection Program” is a plant-specific program. The applicant noted in its amendment letter that this change affected several AMR line items. The staff evaluation of these amended AMR line items are provided below.

LRA Table 3.4.1, Item 3.4.1-35 and Item 3.4.1-36 addresses loss of material due to selective leaching for copper alloy with 15% zinc or more and gray cast iron components exposed to raw water and treated water environment. The LRA references Item 3.4.1-35 and Item 3.4.1-36 in the following systems: Auxiliary Feedwater System, Auxiliary Steam System, Building Services Hot Water Heating System, Condensate System, Glycol Heating System and Water Treatment System.

The LRA credits the AMP B.2.36 “Selective Leaching of Material Inspection Program” to manage this loss of material due to selective leaching for copper alloy with 15% zinc or more heating coil, pump casing and valve body components in a raw water and treated water environment. The LRA also credits the AMP B.2.36 “Selective Leaching of Material Inspection Program” to manage this loss of material due to selective leaching for gray cast iron heating coil, pump casing, tanks, valve bodies, trap body, heat exchanger channel components in a treated water environment only. The GALL Report recommends GALL AMP XI.M33, "Selective Leaching of Materials" to manage this aging effect. The AMR line items that reference this line item in GALL Report Table 1 cite Generic Note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different aging management program is credited. The staff verified that only piping, piping components and piping elements align to GALL Items VIII.E-20, VIII.E-21, VIII.E-23 and VIII.G-36 and are fabricated from copper alloy 15% zinc or more and gray cast iron materials that are applicable to BVPS.

The staff reviewed the Selective Leaching of Materials Inspection Program and its evaluation is documented in SER Section 3.0.3.3.6. The staff determined that the Selective Leaching of Materials Inspection Program, which includes a visual inspection and hardness measurement to determine if selective leaching in the components with-in scope has occurred such that an evaluation of any indications of degradation will be performed to determine whether component intended function is affected and requires corrective actions in accordance with the site’s corrective action program and quality assurance procedures. The staff noted that the applicant’s proposed inspection methods that include a one-time visual inspection and hardness measurement, are consistent with the recommendations provided in GALL AMP XI.M33 to detect loss of material due to selective leaching, and that any indication of degradation based on the results of these inspections will be evaluated under the corrective actions program. On the basis of a one-time visual inspection and hardness measurement on the components that reference Item 3.4.1-35 and 3.4.1-36, the staff finds the applicant's use of the Selective Leaching of Materials Inspection Program acceptable.

SER Section 3.4.2.1 Conclusion: The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing 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 with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.4.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the steam and power conversion systems components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling
- reduction of heat transfer due to fouling
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion
- cracking due to SCC
- loss of material due to pitting and crevice corrosion
- loss of material due to pitting, crevice, and microbiologically-influenced corrosion
- 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 report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.4.2.2.The staff's review of the applicant's further evaluation follows.

3.4.2.2.1 Cumulative Fatigue Damage

LRA Section 3.4.2.2.1 states that management of cumulative fatigue damage in the SPC components is accomplished as a TLAA, as defined in 10 CFR 54.3. In this LRA section, the applicant states that the TLAA analysis for these components is given in LRA Section 4.3.

SRP-LR 3.4.2.2.1 identifies that management of cumulative fatigue damage in SPC components is to be accomplished as a TLAA that meets the definition of a TLAA in 10 CFR 54.3. The SRP-LR Section states that analyzed states that the applicant must evaluate its TLAA for these components in accordance with 10 CFR 54.21(c)(1). SRP-LR references AMR item 1 in Table 4 of the GALL Report, Volume 1, as applicable to the management of cumulative fatigue damage in SPC components.

The staff verified that LRA Table 3.4.1 includes AMR item 3.4.1-01 on management of cumulative fatigue damage in the SPC piping, piping components, and piping elements. The staff verified that in this AMR the applicant identified that it manages cumulative fatigue damage of the ESF piping, piping components, and piping elements in accordance with the TLAA that is provided in LRA Section 4.3. The staff also verified that the applicant provides its TLAA for these components in LRA Section 4.3.2, “Non-Class 1 Fatigue,” which provides the applicant’s TLAA Section for non-ASME Code Class 1 components. The staff finds the applicant’s aging management basis to be acceptable because it is in conformance with the recommendations in SRP-LR Section 3.4.2.2.1 and in AMR item 1 in Table 4 of the GALL Report, Volume 1. The staff documents its evaluation of the applicant’s TLAA for non-Class 1 components in SER Section 4.3.2.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

<u>Steel Piping and Components Exposed to Treated Water and Steam</u>. 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 for steel piping, piping components, and piping elements exposed to steam. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion.
However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow condition. 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. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component’s intended function will be maintained during the period of extended operation.

The staff noted that the AMPs proposed by the applicant for managing this aging effect is the Water Chemistry Program and the One-Time Inspection Program.

The staff reviewed the Water Chemistry Program and finds that it provides for monitoring and controlling of water chemistry using site procedures and processes for the prevention or mitigation of the cracking and loss of material aging effects. The staff’s evaluation of the Water Chemistry Program is documented in SER Section 3.0.3.2.14. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage 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 for steel piping, piping components, and piping elements exposed to steam.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assures the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to confirm 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 for steel piping, piping components, and piping elements exposed to steam is managed.

<u>Steel Piping Components Exposed to Lubricating Oil</u>. SRP-LR Section 3.4.2.2.2.2 states that the GALL Report recommends further evaluation of programs to manage the loss of material due to general, pitting, and crevice corrosion for steel piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on monitoring and control of lubricating oil contamination to maintain contaminants within acceptable limits. The effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The staff noted that the AMPs proposed by the applicant for managing this aging effect is the Lubricating Oil Analysis Program and the One-Time Inspection Program.

The staff reviewed the Lubricating Oil Analysis Program and finds that it maintains oil systems contaminants (primarily water and particulates) within acceptable limits, thereby preserving an environment that is not conducive to loss of material due to general, pitting, and crevice corrosion for steel piping, piping components, and piping elements exposed to lubricating oil. The staff's evaluation of the Lubricating Oil Analysis Program is documented in SER Section 3.0.3.1.13. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to general, pitting, and crevice corrosion for steel piping, piping components, and piping elements exposed to lubricating oil.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assures the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to confirm that loss of material due to general, pitting, and crevice corrosion for steel piping, piping components, and piping elements exposed to lubricating oil is managed.

3.4.2.2.3 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling

SRP-LR Section 3.4.2.2.3 states that loss of material due to general, pitting, crevice, and MIC, and fouling could occur in steel piping, piping components, and piping elements exposed to raw water. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed.

The staff noted that the AMP proposed by the applicant in LRA Section 3.4.2.2.3 for managing this aging effect is the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and finds that it performs periodic visual inspections of internal surfaces during periodic maintenance, predictive maintenance, surveillance testing, and corrective maintenance to detect aging effects that could result in a loss of the component's intended function. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to general, pitting, crevice, and MIC, and fouling that could occur in steel piping, piping components, and piping elements exposed to raw water.

3.4.2.2.4 Reduction of Heat Transfer Due to Fouling

Heat Exchanger Tubes Exposed to Treated Water. SRP-LR Section 3.4.2.2.4 states that, "Reduction of heat transfer due to fouling could occur for stainless steel and copper alloy heat exchanger tubes exposed to treated water. The existing aging management program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may not always have been adequate to preclude fouling. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation."

The staff noted that the AMPs proposed by the applicant in LRA Section 3.4.2.2.4.1 to manage this aging effect is the Water Chemistry Program and the One-Time Inspection Program.

The staff reviewed the Water Chemistry Program and finds that it provides for the monitoring and controlling of water chemistry using site procedures and processed for the prevention or mitigation of the fouling. The staff's evaluation of the Water Chemistry Program is documented in SER Section 3.0.3.2.14. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage reduction of heat transfer due to fouling in stainless steel and copper alloy heat exchanger tubes exposed to treated water during the period of extended operation.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to confirm that reduction of heat transfer due to fouling in stainless steel heat and copper alloy exchanger tubes exposed to treated water is managed during the period of extended operation.

Heat Exchanger Tubes Exposed to Lubricating Oil. SRP-LR Section 3.4.2.2.4.2 states that, "Reduction of heat transfer due to fouling could occur for stainless steel and copper alloy heat exchanger tubes exposed to lubricating oil. The existing aging management program relies on control of lube oil chemistry to manage reduction of heat transfer due to fouling. However, control of lube oil chemistry may not always have been adequate to preclude corrosion. Therefore, the effectiveness of the lubricating oil contaminant control should be verified to ensure that fouling is not occurring. The GALL Report recommends further evaluation of programs to verify effectiveness of lube oil chemistry control program. 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 components intended function will be maintained during the period of extended operation."

The staff noted that the AMPs proposed by the applicant in LRA Section 3.4.3.3.4.2 for managing this aging effect is the Lubricating Oil Analysis Program and the One-Time Inspection Program.

The staff reviewed the Lubricating Oil Analysis Program and finds that it maintains oil systems contaminants (primarily water and particulates) within acceptable limits, thereby preserving an environment that is not conducive to reduction of heat transfer due to fouling in stainless steel and copper alloy heat exchanger tubes exposed to lubricating oil. The staff's evaluation of the Lubricating Oil Analysis Program is documented in SER Section 3.0.3.1.13. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report and are adequate to manage reduction of heat transfer due to fouling in stainless steel and copper alloy heat exchanger tubes exposed to lubricating oil.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to confirm that reduction of heat transfer due to fouling in stainless steel and copper alloy heat exchanger tubes exposed to lubricating oil is managed.

3.4.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

Steel SPC Piping Exposed to Soil. SRP-LR Paragraph 3.4.2.2.5.1 states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion could occur for steel piping, piping components, and piping elements buried in soil.

The applicant manages the external surfaces of piping components exposed to soil in the Auxiliary Feedwater System with the Buried Piping and Tanks Inspection Program, which is evaluated in SER Section 3.0.3.1.8. The staff finds this acceptable because it is in agreement with the recommendations and program element criteria in GALL AMP XI.M34, "Buried Piping and Tanks," for plant tank bottoms in contact with soil.

Steel SPC Heat Exchanger Components Exposed to Lubricating Oil. SRP-LR Section 3.4.2.2.5.2 states that "loss of material due to general, pitting, and crevice corrosion, and MIC could occur in steel heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation."

The staff noted that the applicant in LRA Section 3.4.2.2.5.2 stated that this item is not applicable to BVPS.

The staff noted that the GALL Report Table 1 item recommended by SRP-LR Section 3.4.2.2.5.2 is AMR item 12 in Table 4 of the GALL Report, Volume 1, as applicable to the assessment of loss of material in steel heat exchanger components exposed to lubricating oil. The staff reviewed the applicant's AMR line items and verified that the applicant did not align any of its AMRs for heat exchangers in the SPC systems to AMR item 12 in Table 4 of the GALL Report, Volume 1. Therefore, the staff finds that the applicant has provided an acceptable basis for concluding that the SRP-LR 3.4.2.2.5.2 and the reference GALL AMR item are not applicable to the BVPS LRA because the SPC systems do not include any steel heat exchanger components that are exposed to lubricating oil.

3.4.2.2.6 Cracking Due to Stress Corrosion Cracking

LRA Section 3.4.2.2.6 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.4.2.2.6, "Cracking Due to Stress Corrosion Cracking," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that cracking due to stress corrosion cracking (SCC) is an applicable aging effect requiring management (AERM) for stainless steel and nickel-alloy piping, piping components, and piping elements, tanks, and heat exchanger components under exposure to either a treated water (greater than 60 ºC [140 ºF]) environment or to steam.

The applicant clarifies that since AMR item 13 in the GALL Report, Volume 1 is specific to management of cracking due to SCC in BWR main steam and steam turbine system piping, piping components, and piping elements under exposure to steam. The applicant clarifies, that as a result of this limitation, the AMRs for cracking due to SSC in those stainless steel and nickel-alloy steam and power conversion system piping, piping components, and piping elements, tanks, and heat exchanger components under exposure to steam are covered within the scope of the Type “2” AMRs in LRA Tables 3.4.2-1 through 3.4.2-10 that align to AMR item 14 in Table 4 of the GALL Report, Volume 1.

The applicant states that, for these AMRs, it credits: (1) its Water Chemistry Program to manage cracking due to SCC in these stainless steel, aluminum, and nickel-alloy component surfaces under exposure to a treated water (greater than 60 ºC [140 ºF]) environment or to steam, and (2) its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing this aging effect.

SRP-LR Section 3.4.2.2.6 provides the following guidance on management of cracking due to SCC in stainless steel steam and power conversion system components that are exposed to steam or to a treated water environment in excess of 60°C (>140°F):

> “Cracking due to SCC could occur in the stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60°C (>140°F), and for stainless steel piping, piping components, and piping elements exposed to steam. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of cracking due to SCC. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause SCC. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that SCC is not occurring. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that SCC is not occurring and that the component’s intended function will be maintained during the period of extended operation.”

SRP-LR Section 3.4.2.2.6 does not invoke any PWR-specific AMR items in the GALL Report, Volume 2, that align to GALL AMR item 13 in Table 4 of the GALL Report, Volume 1 for cracking due to SCC in stainless steel steam and power conversion components exposed to steam. Instead, for PWR designs, SRP-LR Section 3.4.2.2.6 invokes AMR Item 14 in Table 4 of the GALL Report, Volume 1, and the following AMR items in the GALL Report Volume 2, as applicable to the management of cracking due to SCC in stainless steel steam and power conversion system components that are exposed to a treated water (greater than 60 ºC [140 ºF]) environment:

- AMR VIII.B1-5, stainless steel piping, piping components and piping elements in the main steam system AMR VIII.C-2, stainless steel piping, piping components and piping elements in the extraction steam system
- AMR VIII.D1-5, stainless steel piping, piping components and piping elements in the feedwater system AMR VIII.E-30, stainless steel piping, piping components and piping elements in the condensate system

- AMR VIII.E-38, stainless steel tanks in the condensate system
- AMR VIII.F-3, stainless steel heat exchanger components in the steam generator blowdown system AMR VIII.F-24, stainless steel piping, piping components and piping elements in the steam generator blowdown system
- AMR VIII.G-33, stainless steel piping, piping components and piping elements in the auxiliary feedwater system

In these AMRs, the GALL Report recommends that the Water Chemistry Program be credited to manage loss of material in the component surfaces that are exposed to treated water and that the One-Time Inspection Program be credited to verify the effectiveness of the Water Chemistry Program in managing this aging effect. This is consistent with the guidance in SRP-LR Section 3.4.2.2.6.

The staff reviewed the information in LRA Section 3.4.2.2.6 and in the AMRs in Type “2” LRA Tables 3.4.2-1 through 3.4.2-10 that align to AMR item 3.4.1-14 in LRA Table 3.4.1 and to AMR item 14 in Table 4 of the GALL Report, Volume 1, against the staff’s recommended AMR guidance in SRP-LR Section 3.4.2.2.6; AMR item 14 in Table 4 of the GALL Report, Volume 1; and AMR items VIII.B1-5, VIII.C-2, VIII.D1-5, VIII.E-30, VIII.E-38, VIII.F-3, VIII.F-24, and VIII.G-33 of the GALL Report, Volume 2.

The staff verified that the applicant included applicable AMRs that align to and are entirely consistent with GALL AMR VIII.B1-5 for the following stainless steel or nickel-alloy main steam/auxiliary steam system components that are exposed to a treated water (greater than 60 ºC [140 ºF]) environment or to steam: (1) heat exchange shells and channels, (2) piping, (3) flow orifices/elements, (4) tubing, (5) valve bodies, (6) turbine casings, and (7) flexible hoses.

The staff verified that the applicant included applicable AMRs that align to and are entirely consistent with GALL AMR VIII.D1-5 for the following stainless steel or nickel-alloy main feedwater system components that are exposed to a treated water (greater than 60 ºC [140 ºF]) environment or to steam: (1) heat exchange shells and channels, (2) piping, (3) tubing, and (4) valve bodies.

The staff verified that the applicant included applicable AMRs that align to and are entirely consistent with GALL AMR VIII.F-24 for the following stainless steel or nickel-alloy steam generator blowdown system components that are exposed to a treated water (greater than 60 ºC [140 ºF]) environment or to steam: (1) piping, and (2) valve bodies.

For these AMRs, the staff verified that the applicant credited: (1) its Water Chemistry Program to manage cracking due to SCC in these stainless steel or nickel-alloy components that are exposed to a treated water (greater than 60 ºC [140 ºF]) environment or to steam, and (2) its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing this aging effect. The staff finds that this provides an acceptable basis for managing cracking due to SCC in the surfaces that are exposed to a treated water (greater than 60 ºC [140 ºF]) environment or to steam because the AMPs credited for aging management are in conformance with the recommended aging management criteria in SRP-LR Section 3.4.2.2.6 and GALL AMRs VIII.B1-5, VIII.D1-5, and VIII.F-24.

The staff noted that the applicant's AMRs aligning to AMR item 14 in Table 4 GALL Report, Volume 1, conservatively included both stainless steel and nickel-alloy steam and power conversion system components that are exposed to a treated water (greater than 60 ºC [140 ºF]) environment or and those that are exposed to a steam environment. However, the staff noted that there were some gaps in the information regarding these AMRs. In particular, the staff noted that the AMRs aligning to AMR item 14 in Table 4 of the GALL Report, Volume 1, did not differentiate between which of these stainless steel or nickel-alloy components are exposed to treated water (greater than 60 ºC [140 ºF]) environment and which of the components are exposed to the steam environment.

The staff also noted that the AMRs aligning to AMR item 14 in Table 4 of the GALL Report, Volume 1, did not include any AMRs aligning to AMR items VIII.C-2, VIII.E-30, VIII.E-38, VIII.F-3, or VIII.G33 in the GALL Report, Volume 2. In RAI 3.4.2.2.6-1, Part 1, the staff asked the applicant to identify which of the Type “2” AMRs aligning to AMR item 14 in Table 4 of GALL Report, Volume 1, were for components that are exposed to the treated water (greater than 60 ºC [140 ºF]) environment and which for components are that are exposed to the steam environment. In RAI 3.4.2.2.6-1, Part 2, the staff asked the applicant to provide its basis for not including any Type “2” AMRs in the LRA that align to AMR items VIII.C-2, VIII.E-30, VIII.E-38, VIII.F-3, or VIII.G-33 in the GALL Report, Volume 2.

The applicant responded to RAI 3.4.2.2.6-1, Parts 1 and 2 in a letter dated July 21, 2008. In the first part of its response dated July 21, 2008, the applicant stated that in License Renewal documentation, it did not distinguish between components that contain treated water in the vapor phase and those that contain treated water in the liquid phase. The applicant explained that it used the "Treated Water" environment to encompass the "Steam" environment. For stainless steel in which the temperature was above the threshold for cracking (whether liquid or vapor phase), it used the environment name "Treated water >60 ºC (>140 ºF)." For cast austenitic stainless steel (CASS) in environments that exceed the threshold temperature for thermal embrittlement of CASS (whether liquid or vapor phase), it used the environment name "Treated water >250 ºC (>482 ºF)."

The applicant further explained that the environment names with temperature distinction were only applied to stainless steel to provide better consistency with the GALL Report (there are no GALL Report rows for other materials in these environments). Aging effects associated with the lower temperature environments were considered matches to the higher temperature environments during GALL Report comparisons (e.g., the aging effect "Loss of material" is applicable to Treated water >60 ºC (>140 ºF), although the GALL Report identifies "Loss of material" for Treated water, but Treated water >60 ºC (>140 ºF) in the GALL Report is only associated with cracking).

The applicant further explained that these environment names were chosen because they correspond to actual aging effect thresholds, and because they correspond exactly to the majority of GALL Report rows that could be used for aging evaluation comparison. The applicant identified that its aging evaluation method used the EPRI Mechanical Tools as the primary aging evaluation reference. In the EPRI Mechanical Tools, the "Treated Water" environment definition includes (encompasses) the "Steam" environment. The applicant stated that the material / aging effects / recommended program assignments in GALL Report Chapter VIII, "Steam and Power Conversion System," include the following AMRs on cracking due to

SCC for stainless steel steam and power conversion system components that are exposed to steam:

- Stainless steel PWR piping, piping components and piping elements recommending Water Chemistry Program for aging management
- Stainless steel BWR piping, piping components and piping elements recommending Water Chemistry Program and One-Time Inspection Program for aging management

The applicant stated that each of these GALL AMRS uses a threshold for initiation of SCC-induced cracking of >60 ºC (>140 ºF) in the case of cracking, with the exception that in the GALL Report AMRs for the PWR components do not recommend that the One-Time Inspection Program be used to verify the effectiveness of the Water Chemistry Program in managing cracking by SCC. The applicant clarified that the only difference in aging comparisons for the applicant's components, when compared to the recommendation for PWR components in the GALL Report is that the applicant replaced the high temperature treated water environment reference in the GALL AMRs with the terminology instead of "Steam" is that the One-Time Inspection Program is recommended by the GALL Report for comparisons to rows citing the "Treated Water" environment, where that program might not be recommended if the rows cite the Steam environment.

The staff reviewed the applicant's response and the GALL Report and found that it provides a conservative aging management approach because the applicant conservatively applied its One-Time Inspection Program to confirm the effectiveness of the Water Chemistry Program in managing cracking by SCC for the stainless steel and nickel-alloy components that are exposed to steam. The staff found this to be a conservative aging management approach because the corresponding AMR items in the GALL Report did not recommend that a One-Time Inspection Program be implemented in conjunction with a Water Chemistry Program for stainless steel or nickel-alloy SPC components that are exposed to dry steam environments.

In the second part of its response dated July 21, 2008, the applicant explained that it did not align to the GALL Report rows cited in the question for aging management comparisons because they are not applicable to BVPS. The material/environment/aging effect/program combination, if present in the BVPS LRA, was also present in another GALL Report Section that was more appropriate.

The applicant explained that its bases for not selecting the referenced GALL Report AMR items are:

> "VIII.C-2 applies to the Extraction Steam System, which is not within the scope of License Renewal at BVPS."
>
> "VIII.E-30 and VIII.E-38 apply to stainless steel components in Treated water >60 ºC (>140 ºC) in the Condensate system. No components that are subject to aging management within the BVPS Condensate system are exposed to an environment that exceeds 60 ºC (>140 ºF)."
>
> "VIII.F-3 applies to Steam Generator Blowdown System stainless steel heat

exchanger components in an environment that is >60°C (>140 ºF). There are no stainless steel heat exchanger components subject to aging management in the BVPS Steam Generator Blowdown System that are exposed to an environment that exceeds 60 ºC (>140 ºF)."

"VIII.G-33 applies to stainless steel components in the Auxiliary Feedwater System in Treated water >60 ºC (>140 ºF). BVPS does not have stainless steel components subject to aging management in the Auxiliary Feedwater System that are exposed to an environment that exceeds 60 ºC (>140 ºF) (piping connected to the Main Feedwater System exceeds that temperature, but it is made of steel, not stainless steel)."

The staff reviewed the second part of the applicant's response to RAI 3.4.2.2.6-1 and finds it adequately describes the basis for excluding the Type 2 AMRs in LRA Tables 3.4.2-1 through 3.4.2-10 that align to AMR items VIII.C-2, VIII.E-30, VIII.E-38, VIII.F-3, or VIII.G-33 in the GALL Report, Volume 2 because either the system for which the component commodity group applies is not within the scope of license renewal and the NRC has verified that this system does not need to be included within the scope of the LRA, or the stainless steel component is not subject to an environment in excess of 60 ºC (>140 ºF), and thus are below the threshold in the GALL AMRs for initiating SCC-induced cracking. Therefore, the staff's concern in the second part of RAI 3.4.2.2.6-1 is resolved.

Conclusion. 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 line items that apply to LRA Section 3.4.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). For those components in which the applicable AMR items in GALL do not apply, the staff has verified that the applicant has provided a valid basis for concluding that the GALL AMR items are not applicable to BVPS because the applicant has either provided a valid basis that the specific subsystem containing components does not need to be within the scope of the LRA or the stainless steel components are not exposed to any environments where the system operating temperature is above the threshold for initiation of cracking by SCC.

3.4.2.2.7 Loss of Material Due to Pitting and Crevice Corrosion

Stainless Steel, Aluminum, and Copper Alloy Components Exposed to Treated Water. LRA Section 3.4.2.2.7.1 addresses the applicant's evaluation on whether the recommended guidance in SRP-LR Section 3.4.2.2.7.1, "Loss of Material Due to Pitting and Crevice Corrosion, *Stainless Steel, Aluminum, and Copper Alloy Components Exposed to Treated Water*," is applicable to the BVPS LRA. In this Section of the LRA, the applicant states that loss of material due to pitting and crevice corrosion is an applicable aging effect requiring management (AERM) for stainless steel, aluminum, and copper alloy steam and power conversion system piping, piping components, and piping elements, tanks, and heat exchanger components that are exposed to a treated water environment. The applicant states that, for these AMRs, it credits: (1) its Water Chemistry Program to manage loss of material due to pitting and crevice corrosion in the stainless steel, aluminum, or copper alloy component surfaces that are exposed to a treated water environment, and (2) its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing this aging effect.

The applicant clarifies that the AMRs on loss of material in the steam-driven auxiliary feedwater pump turbines and heat exchangers in the building services hot water heating system align to this LRA section.

SRP-LR Section 3.4.2.2.7.1 provides the following guidance on management of loss of material due to pitting and crevice corrosion in stainless steel, aluminum, or copper alloy steam and power conversion system components that are exposed to a treated water environment:

> "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 existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to pitting, and crevice corrosion. However, control of water chemistry does not preclude corrosion at locations of stagnant flow conditions. Therefore, the GALL Report recommends that the effectiveness of the water chemistry program should be verified to ensure that corrosion is not occurring. 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."

For PWR designs, SRP-LR Section 3.4.2.2.7.1 invokes AMR Item 15 in Table 4 of the GALL Report, Volume 1, and AMR items VIII.A-5, VIII.D1-1. VIII.E-15, VIII.F-12, VIII.F-15, and VIII.G-17 in the GALL Report Volume 2, as applicable to the management of loss of material due to pitting and crevice corrosion in aluminum and/or copper alloy piping, piping components, and piping elements of the steam turbine, main feedwater, condensate, steam generator blowdown, and auxiliary feedwater systems under exposure to a treated water environment. For PWR designs, SRP-LR Section 3.4.2.2.7.1 also invokes AMR Item 16 in Table 4 of the GALL Report, Volume 1, and AMR items VIII.B1-4, VIII.C-1, VIII.D1-4. VIII.E-4, VIIIE-29, VIII.E-36, VIII.F-23, VIII.F-27, and VIII.G-32 in the GALL Report Volume 2, as applicable to the management of loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements, tanks, and/or heat exchanger components of the main steam, extraction steam, main feedwater, condensate, steam generator blowdown, and auxiliary feedwater systems under exposure to a treated water environment. In these AMRs, the GALL Report recommends that the Water Chemistry Program be credited to manage loss of material in the component surfaces that are exposed to treated water and that the One-Time Inspection Program be credited to verify the effectiveness of the Water Chemistry Program in managing this aging effect. This is consistent with the guidance in SRP-LR Section 3.4.2.2.7.1.

The staff reviewed the information in LRA Section 3.4.2.2.6 and in the AMRs in Type "2" LRA Tables 3.4.2-1 through 3.4.2-10 that align to AMR item 3.4.1-14 in LRA Table 3.4.1 and to AMR item 14 in Table 4 of the GALL Report, Volume 1, against the staff's recommended AMR guidance in SRP-LR Section 3.4.2.2.7.1 and the GALL AMRs invoked by this SRP-LR section.

The staff verified that the applicant included applicable AMRs that align to and are consistent with GALL AMR VIII.A-5 for the following copper alloy and/or aluminum heating coils, and tubing components in the building services hot water heating and glycol heating systems that are exposed to a treated water environment.

The staff verified that the applicant included applicable AMRs that align to and are consistent with GALL AMR VIII.E-15 for the aluminum tanks in the condensate system that are exposed to a treated water environment.

The staff verified that the applicant included applicable AMRs that align to and are consistent with GALL AMR VIII.F-15 for copper alloy heat exchanger tubes in the auxiliary feedwater systems and copper alloy heating coils and pump casings in the glycol heating systems that are exposed to a treated water environment.

The staff verified that the applicant included applicable AMRs that align to and are consistent with GALL AMR VIII.B1-4 for the following stainless steel (including CASS) and/or nickel-alloy components in the auxiliary steam and main steam systems that are exposed to a treated water environment: (1) flexible hoses, (2) flow orifices/elements, (3) turbine casings (auxiliary feedwater system), and (4) valve bodies.

The staff verified that the applicant included applicable AMRs that align to and are consistent with GALL AMR VIII.D-1-4 for the following stainless steel (including CASS) and/or nickel-alloy components in the auxiliary steam and main steam systems that are exposed to a treated water environment: (1) flexible hoses, (2) heat exchanger channels and shells, (3) piping, and (4) tubing, and (5) valve bodies.

The staff verified that the applicant included applicable AMRs that align to and are consistent with GALL AMR VIII.E-29 for the stainless steel (including CASS) piping and valve bodies in the condensate system and water treatment system that are exposed to a treated water environment.

The staff verified that the applicant included applicable AMRs that align to and are consistent with GALL AMR VIII.E-36 for the stainless steel heat exchanger channels and shells in the auxiliary steam system that are exposed to a treated water environment.

The staff verified that the applicant included applicable AMRs that align to and are consistent with GALL AMR VIII.F-23 for the following stainless steel and/or nickel-alloy components in the steam generator blowdown system that are exposed to a treated water environment: (1) pump casings, (2) valve bodies, (3) flexible hoses, (4) filter housings, (5) piping, (6) tanks, (7) tubing, and (8) flow orifices/elements.

The staff verified that the applicant included applicable AMRs that align to and are consistent with GALL AMR VIII.G-32 for the following stainless steel (including CASS) and/or nickel-alloy components in the auxiliary feedwater system that are exposed to a treated water environment: (1) pump casings, (2) valve bodies, (3) flexible hoses, (4) heat exchanger channels, (5) heat exchanger tubes (6) flow orifices/elements, (7) piping, and (8) tubing.

For these AMRs on loss of material, the staff noted that the applicant's AMRs include those for stainless steel, aluminum, or copper alloy S&PC components that are exposed to treated water at temperatures less than or equal to 60 ºC [140 ºF] and bounding AMRs for stainless steel, aluminum, or copper alloy S&PC components that are exposed to treated water at temperatures above 60 ºC [140 ºF]. The staff also noted that the applicant conservatively includes nickel-alloy flexible hoses within the scope of these AMRs. The staff finds this to be conservative because the applicant accounts for the possibility that corrosion might have a higher probability of occurring in those components exposed to treated water at an elevated temperature, and that pitting or crevice corrosion might occur in nickel-alloy materials, even though these materials are designed to be resistant to these aging mechanisms in the absence of environments with halogen or sulfur containing anions or elevated temperatures.

The staff verified that the applicant credited: (1) its Water Chemistry Program to manage loss of material due to pitting and crevice corrosion in the component surfaces that are exposed to a treated water environment (including those exposed to a bounding treated water environment above 60 ºC [140 ºF]), and (2) its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program in managing this aging effect. Based on this review, the staff finds that the applicant has provided an acceptable basis for managing loss of material due to pitting and crevice corrosion in the components surfaces that are exposed to a treated water environment because the AMPs credited for aging management are in conformance with the recommended aging management criteria in SRP-LR Section 3.4.2.2.7.1 and in the specific AMRs in Section VIII of the GALL Report, Volume 2, that apply to these components.

The staff noted that the applicant's AMRs aligning to AMR item 15 in Table 4 GALL Report, Volume 1, did not include any AMRs aligning to AMR items VIII.D1-1, VIII.F-12, or VIII.G17 in the GALL Report, Volume 2. The staff noted that the applicant's AMRs for stainless steel S&PC components aligning to AMR item 16 in Table 4 of the GALL Report, Volume 1, did not include any AMRs aligning to AMR items VIII.C-1, VIII.E-4, or VIII.F-27 in the GALL Report, Volume 2. In RAI 3.4.2.2.7.1-1**,** the staff asked the applicant to provide its basis for not including any Type "2" AMRs in the LRA that align to AMR items VIII.C-1, VIII.D1-1, VIII.E-4, VIII.F-12, VIII.F-27, or VIII.G17 in the GALL Report, Volume 2.

The applicant responded to RAI 3.4.2.2.7.1-1 in a letter dated July 21, 2008. In this letter, the applicant stated that it did not align to the GALL Report rows cited in the question for aging management comparisons because they are not applicable to BVPS. In this response, the applicant provided its bases for not including AMR items in the LRA that corresponding to GALL AMR items VIII.C-1, VIII.D1-1, VIII.E-4, VIII.F-12, VIII.F-27, or VIII.G17 in the GALL Report, Volume 2:

- GALL AMR Item VIII.C-1, which applies to the Extraction Steam System – the applicant clarified that the Extraction Steam System is not within the scope of the BVPS LRA.
- GALL AMR Item VIII.D1-1, which applies to aluminum feedwater system components in a treated water environment – the applicant clarified that the feedwater system does not include any aluminum components that are within the scope of license renewal and are subject to an aging management review.

- GALL AMR Item VIII.E-4, which applies to heat exchangers in the condensate system – the applicant clarified that the condensate systems do not include any heat exchangers that are within the scope of license renewal and are subject to an aging management review.
- GALL AMR Item VIII.F-12, which applies to aluminum components in the Steam Generator Blowdown System – the applicant clarified that the steam generator blowdown systems does not include any aluminum components that are within the scope of license renewal and are subject to aging management review.
- GALL AMR Item VIII.F-27, which applies to stainless steel heat exchanger components in the steam generator blowdown system – the applicant clarified that the steam generator blowdown system does not include any stainless steel heat exchanger components that are within the scope of license renewal and are subject to an aging management review.
- GALL AMR Item VIII.G-17, which applies to aluminum components in the auxiliary feedwater system–the applicant clarified that the auxiliary feedwater system does not include any aluminum components that are within the scope of license renewal and are subject to aging management review.

Based on this review, the staff concludes that the applicant has provided an acceptable basis for concluding that the LRA does not need to include any AMRs aligning to the AMR items VIII.C-1, VIII.D1-1, VIII.E-4, VIII.F-12, VIII.F-27, or VIII.G-17 in the GALL Report, Volume 2 because either: (1) the system in question has been accepted by the NRC as not needing to be within the scope of the LRA, or (2) the specific system does not include the component type or component material addressed in the referenced GALL AMR item. RAI 3.4.2.2.7-1 is resolved.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7.1 criteria. For those line items that apply to LRA Section 3.4.2.2.7.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Stainless Steel Piping Components Exposed to Soil</u>. SRP-LR Paragraph 3.4.2.2.7.2 states that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil.

The applicant manages the external surfaces of piping components exposed to soil with the Buried Piping and Tanks Inspection Program which is discussed in SER Section 3.0.3.1.8. The staff finds this acceptable because it is in agreement with SRP Section 3.2.2.2.9 and the recommendations and program element criteria that are provided in GALL AMP XI.M35, "Buried Piping and Tanks Inspection."

The staff noted, however, that the demineralized water storage tanks used to supply the Unit 1 dedicated auxiliary feedwater pump and the Unit 2 auxiliary feedwater pumps are supported on concrete pads, and that water is excluded from the exterior of the tank bottom surfaces by means of an oil sand bedding in Unit 1, and housing the Unit 2 tank bottom in a concrete structure. The staff noted that the applicant is conservatively treating the tank bottoms as if they were in contact with soil even though they are not. Thus, the staff noted that any potential loss of material for these tank bottoms will be managed by the One-Time Inspection Program. The staff finds this is acceptable because the applicant's basis for crediting the One-Time Inspection Program for aging management is in conformance with the staff's evaluation recommendation in SRP-LR Section 3.2.2.2.3 that a plant-specific AMP be evaluated to ensure that the aging effect is adequately managed.

In LRA Table 3.3.2-14, Row 26 lists there is glass piping exposed to soil and the table indicates there is no aging effect requiring management and, therefore, no aging management program. The staff agrees that there is no aging effect of glass in contact with soil because to date their has not been any applicable operating experience that indicated that loss of material mechanisms or cracking mechanisms are applicable to glass components in a soil environment.

Copper Alloy Piping Components Exposed to Lubricating Oil. The SRP-LR Section 3.4.2.2.7.3 states that, "Loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation."

The staff noted that the AMPs proposed by the applicant in LRA Section 3.4.2.2.7.3 for managing this aging effect is the Lubricating Oil Analysis Program and the One-Time Inspection Program.

The staff reviewed the Lubricating Oil Analysis Program and finds that it maintains oil systems contaminants (primarily water and particulates) within acceptable limits, thereby preserving an environment that is not conducive to loss of material due to pitting and crevice corrosion that could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The staff's evaluation of the Lubricating Oil Analysis Program is documented in SER Section 3.0.3.1.13. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to pitting and crevice corrosion that could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to confirm that loss of material due to pitting and crevice corrosion that could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil is managed.

3.4.2.2.8 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

SRP-LR Section 3.4.2.2.8 states that, "Loss of material due to pitting, crevice, and MIC could occur in stainless steel piping, piping, components, piping elements, and heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation."

The staff noted that the AMPs proposed by the applicant in LRA Section 3.4.2.2.8 for managing this aging effect are the Lubricating Oil Analysis Program and the One-Time Inspection Program.

The staff reviewed the Lubricating Oil Analysis Program and finds that it maintains oil systems contaminants (primarily water and particulates) within acceptable limits, thereby preserving an environment that is not conducive to loss of material due to pitting, crevice, and MIC that could occur in stainless steel piping, piping, components, piping elements, and heat exchanger components exposed to lubricating oil. The staff's evaluation of the Lubricating Oil Analysis Program is documented in SER Section 3.0.3.1.13. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage loss of material due to pitting, crevice, and MIC that could occur in stainless steel piping, piping, components, piping elements, and heat exchanger components exposed to lubricating oil.

The staff reviewed the One-Time Inspection Program and finds that it provides an inspection that either verifies that unacceptable degradation is not occurring or triggers additional actions that assure the intended function of affected components will be maintained during the period of extended operation. The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to confirm that loss of material due to pitting, crevice, and MIC that could occur in stainless steel piping, piping, components, piping elements, and heat exchanger components exposed to lubricating oil is managed.

3.4.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

SRP-LR Section 3.4.2.2.9 identifies that loss of material due to general, pitting, crevice, and galvanic corrosion can occur for steel heat exchanger components exposed to treated water.

The BVPS Condenate System heat exchanger components exposed to treated water are not within the scope of license renewal and the GALL row that aligns to this item is specific to BWRs. Therefore, the applicant states that this item is not applicable to BVPS, a PWR. The staff agrees that these components are not in scope of license renewal and, as a result, are not applicable to BVPS.

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 3.4.2-10, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.4.2-1 through 3.4.2-10, the applicant indicated, via notes F through J, which the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.4.2.3.1 Auxiliary Feedwater System - Summary of Aging Management Evaluation – LRA Table 3.4.2-1

The staff reviewed LRA Table 3.4.2-1, which summarizes the results of AMR evaluations for the auxiliary feedwater system component groups.

In Table LRA 3.4.2-1, the applicant proposed to manage loss of material of stainless steel tank and valve bodies exposed to an internal environment of condensation using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. For these components the applicant cites Note G, which indicates that environment is not in the GALL Report for this component and material. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" addresses only internal surfaces of steel piping, the aging mechanism of general, pitting or crevice corrosion show similar characteristics for all metallic materials. Thus, corrosion on stainless steel internal surfaces will look similar to corrosion on carbon steel surfaces. Since the applicant proposes to perform visual inspection of internal surfaces during maintenance activities when the surfaces are made accessible, or during periodic system and component surveillance tests, the staff finds that the aging effect of loss of material in stainless steel tank and valve bodies exposed to an interior environment of condensation will be adequately managed by using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.4.2-1, "Steam and Power Conversion Systems – Auxiliary Feedwater System – Summary of Aging Management Review, the applicant provide its plant-specific AMRs for managing cracking and hardening and loss of strength due to elastomer degradation in the elastomeric flexible hoses of the auxiliary feedwater system that are exposed externally to uncontrolled indoor air. In this AMR, the applicant identifies that cracking and hardening and loss of strength due to elastomeric degradation is an applicable aging effect requiring management (AERM) for the component surfaces that are exposed externally to the uncontrolled indoor air environment.

The applicant credits its External Surfaces Monitoring Program to manage cracking and hardening and loss of strength in the external surfaces that are exposed to the uncontrolled indoor air environment.

The staff noted that the applicant credits its External Surfaces Monitoring Program to manage cracking and hardening and loss of strength in the elastomeric flexible hoses in the auxiliary feedwater system that are exposed externally to uncontrolled indoor air. The staff noted that the applicant has categorized this AMP as an AMP that is entirely consistent with the program elements in GALL AMP XI.M36, "External Surfaces Monitoring," without exception or enhancement. The staff reviewed the program description and program elements for GALL AMP XI.M36 and noted that the scope of GALL AMP XI.M36, "External Surfaces Monitoring," is currently limited to the inspection of steel (i.e., carbon steel, alloy steel, or cast iron) components in order to manage: (1) loss of material that may occur in the steel components as a result of general corrosion, pitting corrosion, or crevice corrosion, or (2) cracking in the coatings that may be to line the external surfaces of these steel components. The staff noted that GALL AMP XI.M36, "External Surfaces Monitoring," does not apply to elastomeric components or to the management of cracking, hardening, or loss of strength in elastomeric components. Thus, the staff had the following issues with regard to crediting the External Surfaces Monitoring Program to manage hardening and loss of strength in these elastomeric seals or components:

1. The scope of the GALL AMP XI.M36, "External Surfaces Monitoring," does not include elastomeric components nor does it apply to the management of changes in material properties (such as hardening and loss of strength) that may occur in elastomeric components.
2. The applicant's program credits only visual examinations of the external seal surfaces as its basis for managing hardening and loss of strength in the elastomeric surfaces that are exposed, either internally or externally, to uncontrolled indoor air or dry air. Visual examination techniques in ASME Code Section XI, Article IWA-2000 do not credit the visual examination as being acceptable inspection techniques for managing changes in the material properties (such as hardening or loss of strength) that may occur in elastomeric components.

In RAI 3.3.2.2.5.1-1/3.4.2.3-1A**,** the staff asked the applicant to justify using the External Surfaces Monitoring Program as the basis for managing cracking and hardening or loss of strength in: (1) the elastomeric seals or components in the applicant's auxiliary systems under exposure, either internally or externally, to uncontrolled indoor air or dry air, and (2) the elastomeric flexible hoses in the auxiliary feedwater system that are exposed externally to uncontrolled indoor air.

The applicant responded to RAI 3.3.2.2.5.1-1/3.4.2.3-1A in a letter dated July 21, 2008. In its response to the first part of the RAI, the applicant stated that that the BVPS External Surfaces Monitoring Program implements aging management elements described in the GALL Report, XI.M36, "External Surfaces Monitoring," program. The applicant stated that additionally, the BVPS External Surfaces Monitoring Program contains increased scope beyond the GALL Report program to include aging management of elastomeric ventilation flexible connections. The applicant further explained that this increased scope includes new inspection activities in addition to the visual inspections, such as physical manipulation of elastomeric components, to identify aging effects that are unique to elastomers. The applicant also stated that a visual examination alone is insufficient to identify hardening and loss of strength, and may not be sufficient to identify cracking. The applicant explained that it did not originally identify the elastomer increased scope nor include an evaluation of the 10 program elements related to the increased scope in the External Surfaces Monitoring Program discussion in Appendix B of the LRA. The applicant also stated that LRA Section B.2.15 is revised to include the 10-element summary description for the aging management of elastomeric components by the BVPS External Surfaces Monitoring Program.

The applicant also clarified that, for those elastomeric components in the RCS, ESF, auxiliary systems and steam and power conversions systems that are not elastomeric flexible ventilation connections components, the applicant will place the components into a maintenance program that will replace the components based on a qualified life, such as that which is based on vendor recommendations or from actual plant operating experience. The applicant explained that this change will enable the applicant to designate these components as "short-lived" that that they are not subject to aging management. The staff verified that the applicant made the applicable amendments of the LRA in the FENOC letter of July 21, 2008. The staff noted that this is an acceptable basis because the LRA amendment eliminates the need to subject these components to an AMR, which would otherwise be required pursuant to 10 CFR 54.21(a)(1)(ii) if the components were designated as passive and "long lived." Thus, the staff finds this to be acceptable because is consistent with the AMR screening criteria in 10 CFR 54.21(a)(1).

Based on this review, the finds the applicant has adequately addressed aging management of elastomeric components in both the auxiliary systems and steam and power conversion systems because for the elastomeric components that are not flexible ventilation connections (hoses), the applicant has amended the LRA to place the components in a periodic replacement program that eliminates the need to includes these components in an ARM, as would otherwise be required by 10 CFR 54.21(a)(1)(ii) if the components were subject to replacement on a qualified life or specified time period. The staff's issues raised in RAIs 3.3.2.3-3/3.4.3.4-3 and 3.3.2.2.5.1-1/3.4.2.3-1A with respect to these AMRs are resolved.

In LRA Table 3.4.2-1, "Steam and Power Conversion Systems – Auxiliary Feedwater System – Summary of Aging Management Review, the applicant includes plant-specific AMRs for the elastomeric flexible hoses in the auxiliary feedwater systems that are either exposed externally to air with borated water leakage or to lubricating oil. In these AMRs, the applicant identifies that there are not any aging effects requiring management (AERMs) for the surfaces that are either exposed externally to air with borated water leakage or lubricating oil.

The staff reviewed the applicant’s plant-specific AMRs for the elastomeric auxiliary feedwater system flexible hoses that are exposed to either air with borated water leakage or lubricating oil against the criteria summarized in this evaluation. The staff noted that the applicant did not provide any technical bases in the LRA to support its determination that there are not any AERMs for elastomeric auxiliary system components that are exposed to either an external air with borated water leakage environment or a lubricating oil environment. The staff issued RAI 3.3.2.3-3/3.4.2.3-3 to request identification of the specific elastomeric materials that were used in fabrication of the elastomeric components listed in these AMR items and to provide a more detailed technical basis on whether there are any AERMs for the component-elastomer material-environment combinations in these AMRs.

The applicant responded to RAI 3.3.2.3-3/3.4.2.3-3 in a letter dated July 21, 2008. In its response, the applicant stated that BVPS LRA is revised to include new License Renewal Commitment Nos. 21 for Unit 1 and 23 for Unit 2 on the application. In these commitments, with the exception of elastomeric flexible ventilation connection components, the applicant committed to performing repetitive maintenance tasks of the elastomeric components prior to the period of extended operation and to replace the non-flexible ventilation elastomeric components identified in LRA Sections 3.1, 3.2, 3.3, and 3.4 on a specified frequency such that the components are classified as "short-lived" and not subject to aging management per 10 CFR 54.21(a)(1)(ii). The applicant clarified that the frequency of the repetitive tasks will be determined based upon manufacturer recommendations and operating experience. The applicant stated that the LRA is further revised to delete the AMR items for these elastomeric components from the scope of the LRA.

The staff verified that, in the applicant letter of July 21, 2008, the applicant placed Commitment Nos. 21 for Unit 1 and 23 for Unit 2 of the application, as stated above. The issues raised in RAI 3.3.2.3-3/3.4.2.3-3 relative to these AMRs is resolved because the applicant has amended the application to remove these AMRs from the LRA and instead has committed to placing these elastomeric components in a periodic preventative maintenance and replacement program such that the components no longer need to be managed with the scope of AMR under the requirements of 10 CFR 54.21(a)(1)(ii). The staff’s issues raised in RAIs 3.3.2.3-3/3.4.2.3-3 and 3.3.2.2.5.1-1/3.4.2.3-1 with respect to these AMRs are resolved.

In Table 3.4.2-1, the applicant identified no aging effects for copper alloy <15% Zn tubing exposed to air with borated water leakage – EXT and applied Note G to this item. Air with borated water leakage – External is not an environment covered in GALL for copper alloy <15% Zn. The staff reviewed the GALL Report VII.J.5 and finds that with the exception of high-zinc brasses (e.g. >15% Zn), copper and copper alloys have a high resistance to boric acid corrosion. Therefore, loss of material by boric acid wastage is not an applicable aging effect for copper alloy <15% Zn tubing exposed to air with borated water leakage. On this basis, the staff finds that copper alloy <15% Zn tubing exposed to air with borated water leakage – EXT exhibits no aging effect, and that the component or structure will remain capable of performing its intended functions consistent with the CLB during the period of extended operation. Therefore, the staff finds that this line item is acceptable.

In LRA Table 3.4.2-1, the applicant proposed that sight glass exposed to air with borated water leakage-external would have no aging effect requiring management and, therefore would not require an aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

In LRA Table 3.4.2-1, the applicant proposed that the nickel-alloy flexible hoses in the auxiliary feedwater system do not have any aging effects requiring management (AERMs) for the external surfaces that are exposed to an air with borated water leakage environment and do not need any aging management programs for the period of extended operation.

The staff noted that the American Welding Society (AWS) “Welding Handbook,” (Seventh Edition, Volume 4, 1982, Library of Congress) identifies that nickel chromium alloy materials that are alloyed with iron, molybdenum, tungsten, cobalt or copper in various combinations have improved corrosion resistance. Thus, based on this information, the staff finds that the applicant has provided an acceptable basis for concluding that these nickel-alloy flexible hoses do not have any AERMs for the external surfaces that are exposed to an external air with borated water leakage environment because the alloying contents of these components are designed to be resistant to the phenomena of corrosion and oxidation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.2 Auxiliary Steam System - Summary of Aging Management Evaluation – LRA Table 3.4.2-2

The staff reviewed LRA Table 3.4.2-2, which summarizes the results of AMR evaluations for the auxiliary steam system component groups.

In LRA Table 3.4.2-2, the applicant proposed to manage cumulative fatigue damage of stainless steel bolting exposed to uncontrolled indoor air on the external surface and stainless steel orifices, tubing and valve bodies exposed to treated water >60°C (>140°F) as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.4.2-2, the applicant proposed to manage cumulative fatigue damage of nickel-alloy flexible hoses exposed to treated water as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.4.2-2, the applicant proposed that sight glass exposed to air with borated water leakage-external would have no aging effect requiring management and, therefore would not require an aging management program. Air with borated water leakage-external is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to treated borated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.
On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.3 Building Services Hot Water Heating System - Summary of Aging Management Evaluation – LRA Table 3.4.2-3

The staff reviewed LRA Table 3.4.2-3, which summarizes the results of AMR evaluations for the building services hot water heating system component groups.

In LRA Table 3.4.2-3, the applicant proposed to manage cumulative fatigue damage of steel and stainless steel bolting exposed to uncontrolled indoor air on the external surface as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.4.2-3 the applicant proposed to manage cracking of copper alloy >15% Zn exposed to treated water using the Water Chemistry and One-Time Inspection Programs. During its review, the staff noted that the applicant applied Note H to these items. The staff reviewed the AMR results line that references Note H and determined that the aging effect for the component type, material, and environment are not within the GALL Report.

The staff noted that the applicant’s proposed programs would be effective in preventing, monitoring, and detecting this aging effect because the Water Chemistry Program mitigates corrosion by ensuring that water chemistry parameters are kept within EPRI Guidelines that the staff has accepted. Furthermore, the One-Time Inspection Program verifies the effectiveness of the Water Chemistry Program by inspecting for the occurrence of the aging effects. The staff’s evaluation of the Water Chemistry Program is documented in SER Section 3.0.3.2.14. The staff’s evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.17. On this basis, the staff finds that this aging effect is appropriate and will be adequately managed by Water Chemistry Program and the One-Time Inspection Program. Therefore, the staff finds that this line item is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.4 Condensate System (Unit 1 only) - Summary of Aging Management Evaluation – LRA Table 3.4.2-4

The staff reviewed LRA Table 3.4.2-4, which summarizes the results of AMR evaluations for the condensate system (Unit 1 only) component groups.

In LRA Table 3.4.2-4, the applicant includes its plant-specific AMR items on exposure of external austenitic stainless steel (including cast austenitic stainless steel or CASS) component surfaces in the condensate system that are exposed to an outdoor air environment. The scope of these AMR items are applicable to stainless steel bolting, piping, and tanks and CASS valve bodies in the condensation system. In the AMR items for the stainless steel bolting, piping, and the CASS valve bodies, the applicant states that there are not any aging effects requiring management for the external component surfaces that are exposed to the outdoor air environment. In the AMR item for the stainless steel tanks, the applicant assumed that the external surfaces in the bottom of the tanks could be subject to loss of material (corrosion) because of the potential for pooling to occur (where contaminants could accumulate) and at the tank aluminum-to-stainless steel transition welds where loss of material could occur as a result of galvanic corrosion. For these external tank surfaces, the applicant credited its External Surfaces Monitoring Program to manage loss of material in the external component surfaces.

The staff noted that the stainless steel (including) components associated with these Footnote G AMR items are exposed to externally outdoor air. GALL Volume 2 Table IX.D indicates that the scope of outdoor air environments include exposure to weather conditions, including wind and precipitation. The American Welding Society (AWS) “Welding Handbook,” (Seventh Edition, Volume 4, 1982, Library of Congress) identifies that austenitic stainless steel materials are designed to be resistant to the phenomena of corrosion and oxidation primarily as a result of the chromium and nickel-alloying contents. The SCC in stainless steel, which is considered plausible in wetted corrosive environments with a temperature greater than 140 ^{o}F , will not occur in the outside air environment. Thus, based on this information, the staff finds that the applicant has provided an acceptable basis for concluding that the external surfaces and CASS valve body surfaces are not subject to aging effects because any precipitation on the component surfaces only occurs on an intermittent basis (which conforms to the staff’s position SRP-LR Section A.1.2.1.7 for treating the precipitation as an abnormal event) and because the stainless steel materials (including CASS) used to fabricate the components are designed to resistant to the phenomena of corrosion and oxidation.

The staff noted that the applicant has conservatively assumed that the external surfaces of the stainless steel tanks in the condensate system could be subject to loss of material as a result of either galvanic corrosion or periodic water pooling and that the applicant credited its External Surfaces Monitoring Program to manage the aging effect. The NRC’s recommended program elements in GALL AMP XI.36, “External Surfaces Monitoring” are applicable to the management of loss of material in the external surfaces of steel (i.e. carbon steel, alloy steel, or cast iron alloys) components. In the “scope of program” program element in GALL AMP XI.M36, the staff takes the following position on using the visual examinations of this program to manage loss of material in external component surfaces:

> "Visual inspections are expected to identify loss of material due to general corrosion in accessible steel components. Loss of material due to pitting and crevice corrosion may not be detectable through these same visual inspections, however, general corrosion is expected to be present and detectable such that, should pitting and crevice corrosion exist, general corrosion will manifest itself as visible rust or rust byproducts (e.g., discoloration or coating degradation) and be detectable prior to any loss of intended function. Therefore, this program is acceptable for use in inspecting for loss of material for general, pitting and crevice corrosion."

Even though austenitic stainless steel materials (including CASS) are designed to be resistant to corrosion and oxidation because of their nickel and chromium contents (Welding Handbook, Volume 4, Seventh Edition), the staff finds that the applicant has taken a conservative position in crediting its External Surfaces Monitoring Program to manage loss of material in these austenitic stainless steel components because the stainless steel materials used in the fabrication of these components are generally more resistant to a moist environment (such as condensation) than are steel components and because the applicant will conservatively apply the periodic visual examinations of the program to monitor for loss of material that may occur in the external component surfaces that are exposed to outdoor air environment.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations that are not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In LRA Table 3.4.2-4, the applicant proposed to manage loss of material of stainless steel and aluminum tanks exposed to an internal environment of condensation using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. For these components the applicant cites Note G, which indicates that environment is not in the GALL Report for this component and material. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38,"Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," addresses only internal surfaces of steel piping, the aging mechanism of general, pitting or crevice corrosion show similar characteristics for all metallic materials. Thus, corrosion on stainless steel or aluminum internal surfaces will look similar to corrosion on carbon steel surfaces. Since the applicant proposes to perform visual inspection of internal surfaces during maintenance activities when the surfaces are made accessible, or during periodic system and component surveillance tests, the staff finds that the aging effect of loss of material in stainless steel and aluminum tanks exposed to an internal environment of condensation will be adequately managed by using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.4.2-4, the applicant proposed to manage loss of material of aluminum tanks exposed to a soil external environment using the One-Time Inspection Program. During its review, the staff noted that the applicant applied Note G to this item. The staff reviewed the AMR results line that references Note G. The One-Time Inspection Program was reviewed by the staff in SER Section 3.0.3.1.17. Soil is not an environment covered in the GALL Report for loss of material of aluminum tanks. However, the staff's evaluation of the program finds that it would be effective in detecting this aging effect because it would perform visual inspections of the external tank surfaces exposed to soil by volumetric examination prior to the period of extended operation. On this basis, the staff finds that this aging effect will be adequately managed by the One-Time Inspection Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.5 Glycol Heating System (Unit 1 only) - Summary of Aging Management Evaluation – LRA Table 3.4.2-5

The staff reviewed LRA Table 3.4.2-5, which summarizes the results of AMR evaluations for the glycol heating system (Unit 1 only) component groups.

In LRA Table 3.4.2-5, the applicant proposed to manage cumulative fatigue damage of steel bolting exposed to uncontrolled indoor air on the external surface as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.6 Main Feedwater System - Summary of Aging Management Evaluation – LRA Table 3.4.2-6

The staff reviewed LRA Table 3.4.2-6, which summarizes the results of AMR evaluations for the main feedwater system component groups.

In LRA Table 3.4.2-6, the applicant proposed to manage cumulative fatigue damage of stainless steel bolting exposed to uncontrolled indoor air on the external surface and stainless steel piping, tubing and valve bodies exposed to treated water >60°C (>140°F) as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.4.2-6, the applicant proposed to manage cumulative fatigue damage of steel bolting exposed to uncontrolled indoor air on the external surface as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.4.2-6, the applicant proposed to manage cumulative fatigue damage of nickel-alloy flexible hoses exposed treated water as a TLAA. The staff verified that in LRA

Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report.

The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.7 Main Steam System - Summary of Aging Management Evaluation – LRA Table 3.4.2-7

The staff reviewed LRA Table 3.4.2-7, which summarizes the results of AMR evaluations for the main steam system component groups.

In LRA Table 3.4.2-7, the applicant proposed to manage cumulative fatigue damage of steel bolting exposed to uncontrolled indoor air on the external surface as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.4.2-7, the applicant proposed to manage cumulative fatigue damage of stainless steel tubing and valve bodies and nickel-alloy flexible hoses exposed to treated water >60°C (>140°F) as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.4.2-7, the applicant proposed to manage cumulative fatigue damage of cast austenitic stainless steel valve bodies exposed to treated water >250°C (>482°F) as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.4.2-7, the applicant proposed that the nickel-alloy flexible hoses in the main steam system do not have any aging effects requiring management (AERMs) for the external surfaces that are exposed to an air with borated water leakage environment and do not need any aging management programs for the period of extended operation.

The staff noted that the American Welding Society (AWS) “Welding Handbook,” (Seventh Edition, Volume 4, 1982, Library of Congress) identifies that nickel chromium alloy materials that are alloyed with iron, molybdenum, tungsten, cobalt or copper in various combinations have improved corrosion resistance. Thus, based on this information, the staff finds that the applicant has provided an acceptable basis for concluding that these nickel-alloy flexible hoses do not have any AERMs for the external surfaces that are exposed to an external air with borated water leakage environment because the alloying contents of these components are designed to be resistant to the phenomena of corrosion and oxidation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.8 Main Turbine and Condenser System - Summary of Aging Management Evaluation – LRA Table 3.4.2-8

The staff reviewed LRA Table 3.4.2-8, which summarizes the results of AMR evaluations for the main turbine and condenser system component groups.

In LRA Table 3.4.2-8, the applicant proposed to manage loss of material of the gray cast iron trap body exposed to condensation – external, using the Selective Leaching of Materials Inspection Program (B.2.36). The Selective Leaching of Materials Inspection Program was reviewed by the staff in SER Section 3.0.3.z. Condenstation – external is not an environment covered in GALL. However, there are similar environments covered in the GALL Report for gray cast iron where loss of material is the aging effect requiring management and Selective Leaching of Materials (XI.M33) is the AMP. Because the environment, condensation - external, is similar to environments listed in the GALL Report, such as treated water, raw water, and closed cycle cooling water, the staff finds that this line item is acceptable.

In LRA Table 3.4.2-8, the applicant proposed to manage loss of material of stainless steel piping and valve bodies exposed to an internal environment of condensation using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. For these components the applicant cites Note G, which indicates that the environment is not in the GALL Report for this component and material. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” addresses only internal surfaces of steel piping, the aging mechanism of general, pitting or crevice corrosion show similar characteristics for all metallic materials. Thus, corrosion on stainless steel or aluminum internal surfaces will look similar to corrosion on carbon steel surfaces. Since the applicant proposes to perform visual inspection of internal surfaces during maintenance activities when the surfaces are made accessible, or during periodic system and component surveillance tests, the staff finds that the aging effect of loss of material in stainless steel piping and valve bodies exposed to an interior environment of condensation will be adequately managed by using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.9 Steam Generator Blowdown System - Summary of Aging Management Evaluation – LRA Table 3.4.2-9

The staff reviewed LRA Table 3.4.2-9, which summarizes the results of AMR evaluations for the steam generator blowdown system component groups.

In LRA Table 3.4.2-9, the applicant proposed to manage cumulative fatigue damage of stainless steel piping and valve bodies exposed to treated water >60°C (>140°F) as a TLAA.

The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Table 3.4.2-9, the applicant proposed to manage cumulative fatigue damage of cast austenitic stainless steel valve bodies (BVPS Unit 2) exposed to treated water >250°C (>482°F) as a TLAA. The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for this component. SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.10 Water Treatment System - Summary of Aging Management Evaluation – LRA Table 3.4.2-10

The staff reviewed LRA Table 3.4.2-10, which summarizes the results of AMR evaluations for the water treatment system component groups.

In LRA Table 3.4.2-10, the applicant includes its plant-specific AMR items on exposure of external austenitic stainless steel (including cast austenitic stainless steel or CASS) component surfaces in the water treatment system that are exposed to an outdoor air environment. The scope of these AMR items are applicable to stainless steel bolting, piping, and tanks in the water treatment system. In the AMR items for the stainless steel bolting and piping, the applicant states that there are not any aging effects requiring management for the external component surfaces that are exposed to the outdoor air environment. In the AMR item for the stainless steel tanks, the applicant assumed that the external surfaces in the bottom of the tanks could be subject to loss of material (corrosion) because of the potential for pooling to occur (where contaminants could accumulate) and at the tank aluminum-to-stainless steel transition welds where loss of material could occur as a result of galvanic corrosion. For these external tank surfaces, the applicant credited its External Surfaces Monitoring Program to manage loss of material in the external component surfaces.

The staff noted that the stainless steel (including) components associated with these Footnote G AMR items are exposed to externally outdoor air. The staff also noted that GALL Volume 2 Table IX.D indicates that the scope of outdoor air environments include exposure to weather conditions, including wind and precipitation. The American Welding Society (AWS) “Welding Handbook,” (Seventh Edition, Volume 4, 1982, Library of Congress) identifies that austenitic stainless steel materials are designed to be resistant to the phenomena of corrosion and oxidation primarily as a result of the chromium and nickel-alloying contents. The SCC in stainless steel, which is considered plausible in wetted corrosive environments with a temperature greater than 140 F, will not occur in the outside air environment. Thus, based on this information, the staff finds that the applicant has provided an acceptable basis for concluding that these external stainless steel bolting and piping surfaces and CASS valve body surfaces are not subject to aging effects because the any precipitation on the component surfaces only occurs on an intermittent basis (which conforms to the staff’s position SRP-LR Section A.1.2.1.7 for treating the precipitation as an abnormal event) and because the stainless steel materials (including CASS) used to fabricate the components are designed to resistant to the phenomena of corrosion and oxidation.

The staff noted that the applicant has conservatively assumed that the external surfaces of the stainless steel tanks in the water treatment system could be subject to loss of material as a result of either galvanic corrosion or periodic water pooling and that the applicant credited its External Surfaces Monitoring Program to manage the aging effect. The NRC’s recommended program elements in GALL AMP XI.36, “External Surfaces Monitoring” are applicable to the management of loss of material in the external surfaces of steel (i.e. carbon steel, alloy steel, or cast iron alloys) components. In the “scope of program” program element in GALL AMP XI.M36, the staff takes the following position on using the visual examinations of this program to manage loss of material in external component surfaces:

> “Visual inspections are expected to identify loss of material due to general corrosion in accessible steel components. Loss of material due to pitting and crevice corrosion may not be detectable through these same visual inspections, however, general corrosion is expected to be present and detectable such that, should pitting and crevice corrosion exist, general corrosion will manifest itself as visible rust or rust byproducts (e.g., discoloration or coating degradation) and be detectable prior to any loss of intended function. Therefore, this program is acceptable for use in inspecting for loss of material for general, pitting and crevice corrosion.”

Even though austenitic stainless steel materials (including CASS) are designed to be resistant to corrosion and oxidation because of their nickel and chromium contents (Welding Handbook, Volume 4, Seventh Edition), the staff finds that the applicant has taken a conservative position in crediting its External Surfaces Monitoring Program to manage loss of material in these austenitic stainless steel components because the stainless steel materials used in the fabrication of these components are generally more resistant to a moist environment (such as condensation) than are steel components and because the applicant will conservatively apply the periodic visual examinations of the program to monitor for loss of material that may occur in the external component surfaces that are exposed to outdoor air environment.

In LRA Table 3.4.2-10, the applicant identified no aging effects for stainless steel piping exposed to an exterior environment of outdoor air. The staff finds that stainless steel material is susceptible to aging only if exposed to an aggressive chemical, salt water or buried environments. In a normal atmosphere environment, where rain water would tend to wash the exterior surface material rather than concentrate contaminants, the stainless steel material will have no aging effects. The SCC in stainless steel, which is considered plausible in wetted corrosive environments with a temperature greater than 140 ^{o}F, will not occur in the outside air environment. On this basis, the staff finds that stainless steel in an outside air environment exhibits no aging effect, and that the component or structure will remain capable of performing its intended functions consistent with the CLB during the period of extended operation.

In LRA Table 3.3.2-10, the applicant proposed to manage loss of material of stainless steel tank in an external environment of outdoor air using the External Surfaces Monitoring Program. The applicant identified this aging effect for stainless steel material because water pooling can occur at the base of the tank and can result in a concentration of contaminants. The staff's evaluation of the External Surfaces Monitoring Program is documented in SER Section 3.0.3.1.9. The LRA states that this program is consistent with GALL AMP XI.M36, "External Surfaces Monitoring Program." However, GALL AMP XI.M36 is recommended for managing the aging effect of loss of material of carbon steel components only. The staff issued RAI B.2.15-1C requesting the applicant to justify using the External Surfaces Monitoring Program to manage loss of material of stainless steel components. The RAI response is evaluated in SER Section 3.0.3.1.9 and is found acceptable.

In LRA Table 3.4.2-10, the applicant proposed to manage loss of material of stainless steel piping and valve bodies exposed to an internal environment of condensation using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. For these components the applicant cites Note G, which indicates that the environment is not in the GALL Report for this component and material. The staff's evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.12. Although the GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," addresses only internal surfaces of steel piping, the aging mechanism of general, pitting or crevice corrosion show similar characteristics for all metallic materials. Thus, corrosion on stainless steel or aluminum internal surfaces will look similar to corrosion on carbon steel surfaces. Since the applicant proposes to perform visual inspection of internal surfaces during maintenance activities when the surfaces are made accessible, or during periodic system and component surveillance tests, the staff finds that the aging effect of loss of material in stainless steel piping and valve body exposed to an interior environment of condensation will be adequately managed by using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In LRA Table 3.4.2-10, the applicant proposed that sight glass and tank exposed to condensation would have no aging effect requiring management and, there would be no aging management program. Condensation is not an environment covered in GALL. However, there are similar environments covered in GALL such as glass exposed to raw water and treated water and no aging effect is identified for this combination of material and environment and no aging management is required. This conclusion is based on the fact that no failure due to an aging effect of glass components in environments free of hydrofluoric acid, caustics, or hot water have been recorded in industry at the temperatures or during the time periods of concern for extended operation. For this reason, the staff finds that these line items are acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the steam and power conversion systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5 Aging Management of Containments, Structures, and Component Supports

This Section of the SER documents the staff's review of the applicant's AMR results for the containments, structures and component supports components and component groups of:

- Alternate Intake Structure (Common)
- Auxiliary Building
- Boric Acid Tank Building (Unit 1 only)
- Cable
- Chemical Addition Building (Unit 1 only)
- Condensate Polishing Building (Unit 2 only)
- Control Building (Unit 2 only)
- Decontamination Building
- Diesel Generator Building
- Emergency Outfall Structure (Unit 2 only)
- Emergency Response Facility Diesel Generator Building (Common)
- Emergency Response Facility Substation Building (Common)
- Equipment Hatch Platform
- Fuel Building
- Gaseous Waste Storage Vault
- Guard House (Common)
- Intake Structure (Common)
- Main Steam and Cable Vault
- Pipe Tunnel
- Primary Demineralized Water Storage Tank Pad and Enclosure
- Primary Water Storage Building (Unit 1 only)
- Reactor Containment Building
- Refueling Water Storage Tank and Chemical Addition Tank Pad and Surroundings
- Relay Building (Common)
- Safeguards Building
- Service Building
- Solid Waste Building (Unit 1 only)
- South Office and Shops Building (Common)
- Steam Generator Drain Tank Structure (Unit 1 only)
- Switchyard (Common)

- Turbine Building
- Valve Pit
- Waste Handling Building (Unit 2 only)
- Water Treatment Building (Unit 1 only)
- Yard Structures
- Bulk Structural Commodities

3.5.1 Summary of Technical Information in the Application

In LRA Section 3.5 the applicant provides AMR results for the containments, structures and component supports. LRA Table 3.5.1, "Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containments, Structures, and Component Supports," is the applicant's summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the containments, structures and component supports

As stated in the LRA, the applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the containments, structures, and component supports within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted a review of the AMRs to 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 following programs are credited for managing the aging effects related to the structures and component supports:

- Structures Monitoring Program
- Masonry Wall Program
- Boric Acid Corrosion
- Fire Protection
- Water Chemistry Program
- 10 CFR Part 50, Appendix J
- ASME Section XI, Subsection IWE
- ASME Section XI, Subsection IWF
- ASME Section XI, Subsection IWL
- Electrical Wooden Poles/Structures Inspection (Unit 2 only)

- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Settlement Monitoring (Unit 2 only)

The staff's evaluations of the above AMPs are documented in SER Section 3.0.3. Details of the staff's evaluation of AMR results consistent with the GALL Report are documented in SER Section 3.5.2.1.

In the review, the staff also 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 review evaluations are documented in SER Section 3.5.2.2.

The staff also conducted a technical review of the remaining AMRs that were 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. Finally, the staff reviewed the AMP summary descriptions in the UFSAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the structures and component supports.

Table 3.5-1 summarizes the staff's evaluation of components, aging effects or mechanisms, and AMPs listed in LRA Section 3.5 and addressed in the GALL Report.

Table 3.5-1 Staff Evaluation for Containments, Structures and Component Supports in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
PWR Concrete (Reinforced and Prestressed) and Steel Containments					
Concrete elements: walls, dome, basemat, ring girder, buttresses, containment (as applicable). (3.5.1-1)	Aging of accessible and inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	ISI (IWL) and for inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater if environment is non-aggressive. A plant-specific program is to be evaluated if environment is aggressive.	Yes, plant-specific program is to be evaluated if environment is aggressive.	Structures Monitoring Program	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.1.1.1

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
Concrete elements; All (3.5.1-2)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, If not within the scope of the applicant's structures monitoring program or de-watering system is relied upon	Structures Monitoring Program	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.1.2
Concrete elements: foundation, sub-foundation (3.5.1-3)	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program If a de-watering system is relied upon to control erosion of cement from porous concrete subfoundations, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, If not within the scope of the applicant's structures monitoring program or de-watering system is relied upon	Structures Monitoring Program	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.1.2.
Concrete elements: dome, wall, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable) (3.5.1-4)	Reduction of strength and modulus of concrete due to elevated temperature	plant-specific	Yes, plant-specific if temperature limits are exceeded	N/A	N/A to BVPS. Further evaluations see Section 3.5.2.2.1.3.
3.5.1-5	BWR only	N/A	N/A	N/A	N/A
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	IWE, Appendix J	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.1.4.
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	N/A	N/A to BVPS See Section 3.5.2.1.1
3.5.1-8	BWR Only	N/A	N/A	N/A	N/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
Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers (3.5.1-9)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes TLAA	N/A	Consistent with GALL Report. Further evaluations see Section 3.5
Stainless steel penetration sleeves, penetration bellows, dissimilar metal welds (3.5.1-10)	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examinations/ evaluations for bellows assemblies and dissimilar metal welds.	Yes, detection of aging effects is to be evaluate	N/A	N/A to BVPS. Further evaluations see Section 3.5.2.2.1.7.
3.5.1-11	BWR Only	N/A	N/A	N/A	N/A
Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers (3.5.1-12)	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks	Yes, detection of aging effects is to be evaluated	N/A	N/A to BVPS. Further evaluations see Section 3.5.2.2.1.8.
3.5.1-13	BWR Only	N/A	N/A	N/A	N/A
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	ASME Section XI, Subsection IWL	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.1.9.

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
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 for inaccessible areas	ASME Section XI, Subsection IWL	Consistent with GALL Report. Further evaluations see 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	ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J	Consistent with GALL Report. See Section 3.5.2.1
Personnel airlock, equipment hatch and CRD hatch locks, hinges, and closure mechanisms (3.5.1-17)	Loss of leak tightness in closed position due to mechanical wear of locks, hinges and closure mechanisms	10 CFR Part 50, Appendix J and plant Technical Specifications	No	ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J	Consistent with GALL Report. See Section 3.5.2.1
Steel penetration sleeves and dissimilar metal welds; personnel airlock, equipment hatch and CRD hatch (3.5.1-18)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	No	ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J	Consistent with GALL Report. See Section 3.5.2.1
3.5.1-19	BWR Only	N/A	N/A	N/A	N/A
3.5.1-20	BWR Only	N/A	N/A	N/A	N/A
3.5.1-21	BWR Only	N/A	N/A	N/A	N/A
Prestressed containment: tendons and anchorage components (3.5.1-22)	Loss of material due to corrosion	ISI (IWL)	No	N/A	N/A to BVPS See 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
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 the scope of the applicant's structures monitoring program	N/A	N/A. Further evaluations see Section 3.5.2.2.2.1.1
All Groups except Group 6: interior and above grade exterior concrete (3.5.1-24)	Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	N/A	N/A. Further evaluations see 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	Consistent with GALL Report. Further evaluations see 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	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.2.1.4

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
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	N/A	N/A. Further evaluations see Section 3.5.2.2.2.1.5
Groups 1-3, 5-9: All (3.5.1-28)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if not within the scope of the applicant's structures monitoring program or a de-watering system is relied upon	N/A	N/A. Further evaluations see Section 3.5.2.2.2.1.6
Groups 1-3, 5-9: foundation (3.5.1-29)	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if not within the scope of the applicant's structures monitoring program or a de-watering system is relied upon	N/A	N/A. Further evaluations see Section 3.5.2.2.2.1.7
Group 4: radial beam seats in BWR drywell; RPV support shoes for PWR with nozzle supports; steam generator supports (3.5.1-30)	Lock-up due to wear	ISI (IWF) or Structures Monitoring Program	Yes, if not within the scope of ISI or structures monitoring program	N/A	N/A. Further evaluations see Section 3.5.2.2.2.1.8.

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Groups 1-3, 5, 7-9: below-grade concrete components, such as exterior walls below grade and foundation (3.5.1-31)	Increase in porosity and permeability, cracking, loss of material (spalling, scaling), aggressive chemical attack; cracking, loss of bond, and loss of material (spalling, scaling), corrosion of embedded steel	Structures Monitoring Program; examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant-specific program is to be evaluated if environment is aggressive.	Yes, plant-specific, if environment is aggressive	Structures Monitoring Program	N/A. Further evaluations see Section 3.5.2.2.2.2.4
Groups 1-3, 5, 7-9: exterior above and below grade reinforced concrete foundations (3.5.1-32)	Increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide	Structures Monitoring Program for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes	Structures Monitoring Program	N/A. Further evaluations see 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	A plant-specific aging management program is to be evaluated	Yes, plant-specific if temperature limits are exceeded	N/A	N/A. Further evaluations see 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/US Army Corps of Engineers dam inspections and maintenance programs and for inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant-specific program is to be evaluated if environment is aggressive.	Yes, plant-specific if environment is aggressive	Structures Monitoring Program	N/A. Further evaluations see Section 3.5.2.2.2.4.1

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
Group 6: exterior above and below grade concrete foundation (3.5.1-35)	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Yes, for inaccessible areas of plants located in moderate to severe weathering conditions	Structures Monitoring Program	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.2.4.2.
Group 6: all accessible and inaccessible reinforced concrete (3.5.1-36)	Cracking due to expansion/reaction with aggregates	Accessible areas: Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if concrete was not constructed as stated for inaccessible areas	N/A	N/A. Further evaluations see 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/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if concrete was not constructed as stated for inaccessible areas	N/A	N/A. Further evaluations see Section 3.5.2.2.2.4.3
Groups 7, 8: tank liners (3.5.1-38)	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific	N/A	N/A. Further evaluations see Section 3.5.2.2.2.5.

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-39)	Loss of material due to general and pitting corrosion	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	Structures Monitoring Program	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.2.6
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	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.2.6.
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	N/A. Further evaluation is documented in Section 3.5.2.2.2.6
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	N/A	N/A. Further evaluation is documented in 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	Fire Protection Program and Masonary Wall Program	Consistent with GALL Report. See Section 3.5.2.1.2
Group 6: elastomer seals, gaskets, and moisture barriers (3.5.1-44)	Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	No	Structures Monitoring Program	Consistent with GALL Report. Further evaluations see Section 3.5.2.1
Group 6: exterior above and below grade concrete foundation; interior slab (3.5.1-45)	Loss of material due to abrasion, cavitation	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance	No	Structures Monitoring Program	Consistent with GALL Report. See Section 3.5.2.1.4

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
Group 5: fuel pool liners (3.5.1-46)	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	Water Chemistry and monitoring of spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels.	No	Water Chemistry	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 or FERC/US Army Corps of Engineers dam inspections and maintenance. If protective coatings are relied upon to manage aging, protective coating monitoring and maintenance provisions should be included.	No	Structures Monitoring Program and IWF	Consistent with GALL Report. See Section 3.5.2.1.3
Group 6: earthen water control structures - dams, embankments, reservoirs, channels, canals, and ponds (3.5.1-48)	Loss of material, loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, seepage	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs	No	N/A	N/A to BVPS See Section 3.5.2.1.1
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-49)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and ISI (IWF)	No	Water Chemistry	Consistent with GALL Report. See Section 3.5.2.1
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	IWF	Consistent with GALL Report. See Section 3.5.2.1

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Group B1.1: high strength low-alloy bolts (3.5.1-51)	Cracking due to stress corrosion cracking; loss of material due to general corrosion	Bolting Integrity	No	IWF	N/A. Consistent with GALL Report. See Section 3.5.2.1.1
Groups B2, and B4: sliding support bearings and sliding support surfaces (3.5.1-52)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Structures Monitoring Program	No	N/A	Consistent with the GALL Report. See Section 3.5.2.1
Groups B1.1, B1.2, and B1.3: support members: welds; bolted connections; support anchorage to building structure (3.5.1-53)	Loss of material due to general and pitting corrosion	ISI (IWF)	No	IWF	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.2
Groups B1.1, B1.2, and B1.3: constant and variable load spring hangers; guides; stops; (3.5.1-54)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	IWF	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.2 .
Steel, galvanized steel, and aluminum support members; welds; bolted connections; support anchorage to building structure (3.5.1-55)	Loss of material due to boric acid corrosion	Boric Acid Corrosion	No	Boric Acid Corrosion	Consistent with GALL Report. Further evaluations see Section 3.5.2.2.2
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	IWF	N/A. Further evaluations see Section 3.5.2.2.2

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Groups 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	N/A	N/A to BVPS
Galvanized steel and aluminum support members; welds; bolted connections; support anchorage to building structure exposed to air - indoor uncontrolled (3.5.1-58)	None	None	N/A - No AEM or AMP	None	Consistent with GALL Report. See Section 3.5.2.1
Stainless steel support members; welds; bolted connections; support anchorage to building structure (3.5.1-59)	None	None	NA - No AEM or AMP	None	Consistent with GALL Report. See Section 3.5.2.1

3.5.2.1 AMR Results Consistent with the GALL Report

3.5.2.1.1 Summary of Technical Information in the Application

In LRA Section 3.5.2.1, the applicant identified the materials, environments, and AERMs. The applicant identified the following programs that manage the effects of aging related to the structures and component supports components:

- Structures Monitoring Program
- Masonry Wall Program
- Boric Acid Corrosion
- Fire Protection
- Water Chemistry Program
- 10 CFR Part 50, Appendix J
- ASME Section XI, Subsection IWE

- ASME Section XI, Subsection IWF
- ASME Section XI, Subsection IWL
- Electrical Wooden Poles/Structures Inspection (Unit 2 only)
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Settlement Monitoring (Unit 2 only)

In LRA Tables 3.5.2-1 through 3.5.2-36 the applicant summarized AMRs for the containments, structures and component supports and indicated AMRs claimed to be consistent with the GALL Report.

3.5.2.1.2 Staff Evaluation

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 whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

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

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

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

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

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

The staff reviewed the information in the LRA, as documented in SER Section 3.5.2.1. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.5.2.1.3 AMR Results Identified as Not Applicable

In LRA Table 3.5.1, the applicant identified items 7, 22, 48, 52 and 57 as “Not Applicable" since the component, material, and environment combination does not exist at BVPS. For each of these line items, the staff reviewed the LRA and the applicant's supporting documents, and confirmed the applicant's claim that the component, material, and environment combination does not exist at BVPS. Because BVPS does not have the component, material, and environment combination for these Table 1 line items, the staff finds that these AMRs are not applicable to BVPS.

3.5.2.1.4 Cracking due to Restraint Shrinkage, Creep, and Aggressive Environment

In the discussion Section of LRA Table 3.5.1, item 3.5.1-43, the applicant stated that cracking due to restraint shrinkage, creep, and aggressive environment is managed by the Fire Protection Program. However, the GALL Report does not provide a line in which concrete masonry is inspected per the Fire Protection Program. During the review, the staff noted that the Aging Management Program for the AMR results line points to LRA Table 3.5.1, item 3.5.1-43, and the applicant included a reference to note E.

The staff reviewed the AMR results lines referenced to note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S5, “Masonry Wall Program,” the applicant has proposed using the Fire Protection Program. The GALL Report line item referenced is the masonry block wall, and therefore, the GALL Report recommends AMP XI.S5. The applicant stated that the AMR result line items that reference LRA table 3.5.1 item 3.5.1-43, are also listed as fire barriers that are in the scope for 10 CFR 54.4(a)(2) criterion, and therefore, the Fire Protection Program credited. The Fire Protection Program performs visual inspections on a periodic basis to manage cracking due to restraint shrinkage, creep, and aggressive environments. On the basis that periodic visual inspections are performed, the staff finds the applicant's use of the Fire Protection Program to be acceptable.

On the basis of its review of AMR result lines as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AEM adequately, as recommended by the GALL Report.

3.5.2.1.5 Loss of Material Due to General, Pitting, and Crevice Corrosion

In the discussion Section of LRA Table 3.5.1, item 3.5.1-47, the applicant stated that loss of material due to general, pitting, and crevice corrosion is managed by the Structures Monitoring Program. During the review, the staff noted that for the AMR results line pointing to Table 3.5.1, item 3.5.1-47, the applicant included a reference to note E.

The staff reviewed the AMR results lines referenced to note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," the applicant has proposed using the Structures Monitoring Program. However, the AMR result line items that reference LRA table 3.5.1, item 3.5.1-47, are metal structural members in the Water-Control Structure, which are in the scope for the Structures Monitoring Program and not in the Regulatory Guide 1.127 Program. The Structures Monitoring Program performs visual inspections to manage loss of material due to general, pitting, and crevice corrosion. On the basis that periodic visual inspections are performed, the staff finds the applicant's use of the Structures Monitoring Program acceptable.

During its review, the staff noted that line item 15 of LRA Table 3.5.2-36, for cable trays and conduits component, aluminum material, exposed to raw water environment, and loss of material aging effect, refers to GALL Report Item VII.G-8. GALL Report item VII.G-8 recommends the Fire Protection Program to manage the aging effect. However, the applicant credited the Structures Monitoring Program, and included a reference to note E for this AMR line item. In RAI 3.5.2.1-1, dated May 8, 2008, the staff requested that the applicant explain why the applicant's Fire Protection Program is not credited, and how the applicant's Structures Monitoring Program includes all GALL Report suggested elements of the Fire Protection program for this line item.

In its response dated June 16, 2008, the applicant explained that because the applicant's evaluation is based on the consistency with the GALL Report item for material, environment and aging effect, VII.G-8 is the only available GALL Report item that identifies aluminum components in an untreated water environment. The applicant stated that the Fire Protection Program manages the aging effects on intended function of the penetration seals, fire barrier walls, ceilings, and floors, and all fire rated doors that perform a fire barrier function. The GALL AMP XI.M26, "Fire Protection," does not mention the support of cable trays and conduit, and the applicable components are not specifically associated with fire protection components or functions. The applicant further indicated that cable trays and conduit provide structural support to electrical conductors, and the GALL AMP XI.S6, "Structures Monitoring Program," specially addresses structural components. Therefore, the applicant concluded that the Structures Monitoring Program is appropriate for monitoring the condition and function of such cable trays and conduit, and is the better program to manage aging of cable trays and conduit exposed to raw water.

On the basis of its review of the applicant’s response to RAI 3.5.2.1-1, the staff finds the applicant's use of the Structures Monitoring Program to be acceptable because (1) the intended function of structural support to electrical conductors by cable trays and conduit is addressed by the credited AMP, and (2) periodic visual inspections under the credited AMP are appropriate and adequate to manage loss of material due to general, pitting, and crevice corrosion for cable trays and conduit exposed to raw water. Therefore, the staff’s concern described in RAI 3.5.2.1-1 is resolved.

In the discussion Section of LRA Table 3.5.1, item 3.5.1-47, the applicant stated that the ASME Section XI, Subsection IWF Program is used to manage the corrosion aging effect for support components that are exposed to raw water. During the review, the staff noted that for the AMR results line items 36, 37, 38 and 248 of LRA Table 3.5.2-36 pointing to Table 3.5.1, item 3.5.1-47, the applicant included a reference to note E.

The staff reviewed these AMR result lines referenced to note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants,” the applicant has proposed using the ASME Section XI, Subsection IWF Program. In RAI 3.5.2.1-2, dated May 8, 2008, the staff requested that the applicant discuss how the elements of the RG 1.127 program are included in the applicant’s ASME Section XI, Subsection IWF Program.

In its response dated June 16, 2008, the applicant stated that BVPS does not have water-control structures as defined in RG 1.127; therefore the GALL AMP XI.S7 is not applicable to BVPS. The RG 1.127 program scope is focused on concrete and earthen material, and does not specifically address loss of material of metallic support components. For component and piping supports (ASME class 1, 2 and 3) and for anchor bolts and structural bolts (ASME class 1, 2 and 3 support bolting) in a raw water environment, the applicant further explained that the ASME Section XI, Subsection IWF Program is applicable to aging management of these support components.

On the basis of its review of the applicant’s response to RAI 3.5.2.1-2, the staff finds the applicant's use of the ASME Section XI, Subsection IWF Program to be acceptable because (1) the intended function of ASME class 1, 2 and 3 supports and bolts is addressed by the credited AMP, and (2) periodic visual inspections under the credited AMP are appropriate and adequate to manage loss of material due to general, pitting, and crevice corrosion for metallic support and bolting components in a raw water environment. Therefore, the staff’s concern described in RAI 3.5.2.1-2 is resolved.

During its review, the staff noted that line item 3 of LRA Table 3.5.2-17, for screen guides component, alloy steel material, exposed to raw water environment, and loss of material aging effect, refers to GALL Report Item VII.C3-7. GALL Report item VII.C3-7 suggests the Open-Cycle Cooling Water (OCCW) System Program to manage the aging effect. However, a different aging management program, the applicant’s Structures Monitoring Program, is credited for this item. In RAI 3.5.2.1-3, dated May 8, 2008, the staff requested the applicant to justify why the applicant’s Open-Cycle Cooling Water System Program is not credited, and how the applicant’s Structures Monitoring Program covers all GALL Report suggested elements of the Open-Cycle Cooling Water System Program for this item.

In its response dated June 16, 2008, the applicant explained that the OCCW System Program focuses on assurance of fluid flow through critical cooling components, rather than on structural items, such as the subject Intake Structure traveling screen guides, which function to maintain the screens' alignment during operation, and which transfer load to the concrete walls that support them. The applicant further stated that the Structures Monitoring Program relies on periodic visual inspections to monitor and address the condition and function of structural components such as screen guides.

On the basis of its review of the applicant's response to RAI 3.5.2.1-3, the staff finds the applicant's use of the Structures Monitoring Program to be acceptable because (1) the intended function of structural components of screen guides is addressed by the credited AMP, and (2) periodic visual inspections under the credited AMP are appropriate and adequate to manage loss of material due to general, pitting, and crevice corrosion for screen guides component exposed to raw water. Therefore, the staff's concern described in RAI 3.5.2.1-3 is resolved.

On the basis of its review of AMR result lines as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AERM adequately, as recommended by the GALL Report.

3.5.2.1.6 Loss of Material Due to Abrasion and Cavitation

In the discussion column of LRA Table 3.5.1, item 3.5.1-45, the applicant stated that loss of material due to abrasion and cavitation is managed by the Structures Monitoring Program. During the audit, the staff noted that for the aging management program for the AMR results line that points to Table 3.5.1, item 3.5.1.45, the applicant included a reference to note E.

The applicant was asked to explain why note E was used instead of note A since Table 3.5.1 and Table 3.5.2 are both referring to the Structures Monitoring Program. The applicant also indicated that BVPS inspects the submerged portions of the Intake Structure (Common) and the Alternate Intake Structure (Common) as part of the Structures Monitoring Program. Therefore, the applicant credits the Structures Monitoring Program. The staff reviewed the AMR results for this line item and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," the applicant has proposed using the Structures Monitoring Program because the submerged portions of the Intake Structure (Common) and the Alternate Intake Structure (Common) are part of the Structures Monitoring Program. The Structures Monitoring Program performs visual inspections to manage loss of material due to abrasion and cavitations. On the basis of its review, the staff finds the applicant's use of the Structures Monitoring Program to be acceptable.

On the basis of its review of AMR result lines as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AEM adequately, as recommended by the GALL Report.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing 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 with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.5.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the containments, structures, and component supports, and provides information concerning how it will manage aging effects in the following three areas:

(1) PWR containments:

- aging of inaccessible concrete areas
- cracks and distortion due to increased stress levels from settlement; reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations if not covered by the Structures Monitoring Program
- reduction of strength and modulus of concrete structures due to elevated temperature
- loss of material due to general, pitting, and crevice corrosion
- loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- cumulative fatigue damage
- cracking due to SCC
- cracking due to cyclic loading
- loss of material (scaling, cracking, and spalling) due to freeze-thaw
- cracking due to expansion and reaction with aggregate and increase in porosity and permeability due to leaching of calcium hydroxide

(2) safety-related and other structures and component supports:

- aging of structures not covered by the Structures Monitoring Program
- aging management of inaccessible areas
- reduction of strength and modulus of concrete structures due to elevated temperature
- aging management of inaccessible areas for Group 6 structures
- cracking due to SCC and loss of material due to pitting and crevice corrosion
- aging of supports not covered by the Structures Monitoring Program
- cumulative fatigue damage due to cyclic loading

(3) QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.5.2.2. The staff's review of the applicant's further evaluation follows.

3.5.2.2.1 PWR 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. 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 addresses two areas:

(1) Increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack

    The applicant stated in the LRA that the loss of material and change in material properties due to aggressive chemical attack is not an aging effect requiring management for concrete components below grade at BVPS because (1) groundwater analyses confirm that the BVPS site groundwater is not aggressive, and (2) BVPS concrete is designed in accordance with ACI 318 and constructed in accordance with ACI 301, which enhances the resistance to chemical attack through the use of dense concrete that has low permeability and a low water to cement ratio.

    However, the staff identified two issues where additional clarifications were needed to complete the review. The first issue is that the GALL Report suggests that concrete is constructed in accordance with the recommendations in ACI 201.2R for a quality concrete with low water-to-cement mix ratio (0.35-0.45), smaller aggregate, long curing period, adequate air entrainment (3-6%), and thorough consolidation. RAI 3.5.2.2-1, dated May 8, 2008, was issued to ask the applicant to compare BVPS concrete with ACI 201.2R including water-to-cement ratio and air content.

    The second issue is that the staff is not clear on the frequency of periodic groundwater inspection for chlorides, sulfates, and pH under the applicant's Structures Monitoring Program. RAI B.2.39-2, dated April 30, 2008, was issued to ask the applicant to specify the inspection frequency, and provide the two most recent threshold values. The staff's review of the applicant's Structures Monitoring Program, including responses to RAI B.2.39-2, is documented in SER Section 3.0.3.2.12. In their response, dated June 6, 2008, the applicant stated that the BVPS groundwater chemistry would be monitored on a 5-year interval and provided recent results. The staff agrees that the applicant's 5-year interval for monitoring the BVPS groundwater chemistry is in accordance with the industry's standard, and the latest results meet the GALL Report requirements, which are pH greater than 5.5; chlorides less than 500 ppm; and sulfates less than 1500 ppm.

    In its response, dated June 16, 2008, the applicant responded to RAI 3.5.2.2-1. The applicant stated that the BVPS Unit 1 and Unit 2 construction phase concrete specifications that referenced ACI 301 and ACI 318 were initially issued in 1969 and

1973, respectively, and predated the initial 1977 issue of ACI 201.2R, "Guide to Durable Concrete." Concrete quality for both units was stringently controlled by adherence to these specifications, which were approved by the NRC for plant construction. The applicant provided the detailed information about BVPS concrete against the GALL recommended ACI 201.2R-77 including water-to-cement ratio, selection of aggregate, air entrainment, curing requirement, and consolidation method. The applicant specified in the letter that Unit 1 and Unit 2 structural concrete mixes had water-cement ratios that varied between 0.40 and 0.55, entrained air that ranged from 3% to 8%.

The staff has reviewed the LRA and the additional information provided by the applicant. On the basis of its review, the staff finds that the increases in porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack in inaccessible areas require no further evaluation of plant-specific programs because the environment is not aggressive and the inspection frequency of groundwater chemistries under the applicant's Structures Monitoring Program agrees with the recommendation of the GALL Report for groundwater monitoring.

The staff does not agree with the applicant that the loss of material and change in material properties due to aggressive chemical attack is not an aging effect requiring management for concrete components below grade at BVPS. The concrete water-cement ratio between 0.40 and 0.55 in BVPS is beyond both the GALL Report recommendation (0.35 to 0.45) and the ACI 201.2R-77 guideline. Therefore, the staff disagrees with the applicant's conclusion that there are no aging effects requiring management for the period of extended operation. However, since the applicant has committed to the Structures Monitoring Program to monitor the BVPS groundwater chemistry on a 5-year interval to the end of extended operation period, the staff finds this acceptable. Therefore, the staff's concern described in RAI 3.5.2.2-1 is resolved.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.1 criteria. For those line items that apply to LRA Section 3.5.2.2.1.1, the staff determines that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel

The applicant stated in the LRA that the cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel is not an aging effect requiring management at BVPS because (1) groundwater analyses confirm that the BVPS site groundwater is not aggressive, and (2) the design and construction of the BVPS concrete structures in accordance with ACI 318 and ACI 301 generally prevent corrosion of embedded steel from occurring.

The GALL Report recommends the periodic groundwater inspection for chlorides, sulfates, and pH to ensure non-aggressive groundwater chemistries. The staff noted that the applicant's groundwater inspection program is performed by the applicant's Structures Monitoring Program. RAI B.2.39-2, dated April 30, 2008, was issued to ask the applicant to specify the inspection frequency, and provide the two most recent threshold values. The staff's review of the applicant's Structures Monitoring Program, including responses to RAI B.2.39-2, is documented in SER Section 3.0.3.2.12. In their response, dated June 6, 2008, the applicant stated that the BVPS groundwater chemistry would be monitored on a 5-year interval and provided recent results. The staff agrees that the applicant's 5-year interval for monitoring the BVPS groundwater chemistry is in accordance with the industry's standard, and the latest results meet the GALL Report requirements, which are pH greater than 5.5; chlorides less than 500 ppm; and sulfates less than 1500 ppm.

The GALL Report also suggests that concrete is constructed in accordance with the recommendations in ACI 201.2R for a quality concrete. The staff's discussion and review for the equivalence of BVPS concrete to the ACI 201.2R recommendations is documented in SER Section 3.5.2.2.1.1 Part 1.

In LRA Appendix B.2.5, "ASME Section XI, Subsection IWL," AMP, the applicant indicated that previous BVPS Containment Building inspections have identified minor issues such as mildew and rust stains, spalling, surface cracks, and loose foreign materials. RAI 3.5.2.2.-2 was issued to ask the applicant to clarify if corrosion of embedded steel is the cause for rust stains, spalling and surface cracks.

In its response dated June 16, 2008, the applicant responded to RAI 3.5.2.2-2. The applicant stated as follows:

> The embedded steel items that caused the subject rust stains and small spalls were not load-carrying elements of the wall. Rather, they comprise construction accessories, such as wire tie attachment devices, or form ties that were used to hold forms in-place during construction and left in-place after the wall concrete was poured. These items are close to the exterior surface of the concrete cover layer (the outermost 3 inches that is not included in the wall's design thickness). They could not always be removed when the formwork was removed, and were instead covered by grout. Since they are near the concrete's surface, some of the items rust over time, and the grout over top of them pops off. This wire and form tie corrosion results in staining and small spalls.
>
> Grout was also used to patch surface irregularities remaining after formwork removal, and these grout patches also occasionally spall off over time. The spall is confined to the cover concrete.
>
> A layer of shrinkage and temperature steel does exist under the cover concrete, which serves to limit surface cracking during initial concrete curing and subsequent temperature changes. On a few occasions, this small diameter (1/2 in.) steel has been exposed due to cover concrete spalling, which has also resulted in staining. The spalled areas were repaired in such cases.
>
> The main reinforcing steel has not been found to be the source of rust stains or spalling on the reactor containment.

The staff has reviewed the LRA and the additional information provided by the applicant by letter dated June 16, 2008. On the basis of its review, the staff finds that the cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel require no further evaluation of plant-specific programs because the environment is not aggressive and the inspection frequency of groundwater chemistry under the applicant's Structures Monitoring Program agrees with the recommendation of the GALL Report for groundwater monitoring.

The staff does not agree with the applicant that corrosion of embedded steel is not an aging effect requiring management at BVPS. The staff noted from the applicant responses that shrinkage and temperature steel has been exposed and its concrete cover has been spalling. The GALL Report does not differentiate embedded steel between main reinforcing steel and shrinkage and temperature steel. Concrete cover designed per ACI code should provide sufficient protection for embedded steel. Concrete covers designed per ACI code should provide sufficient protection for embedded steel. Concrete cover spalling indicates the possible mechanism of corrosion of embedded steel. Therefore, the staff disagrees with the applicant's conclusion that there are no aging effects requiring management for the period of extended operation. However, since the applicant has committed to the Structures Monitoring Program to monitor the BVPS groundwater chemistry on a 5-year interval to the end of extended operation period, the staff finds this acceptable. Therefore, the staff's concern described in RAI 3.5.2.2-2 is resolved.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.1 criteria. For those line items that apply to LRA Section 3.5.2.2.1.1, the staff determines that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>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</u>. The staff reviewed LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2.

SRP-LR Section 3.5.2.2.1.2 states that cracks and distortion due to increased stress levels from settlement may occur in PWR and BWR concrete and steel containments. Also, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations may occur in all types of PWR and BWR containments. The existing program relies on structures monitoring to manage these aging effects. Some plants may rely on a de-watering system to lower the site groundwater level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is within the scope of the applicant's structures monitoring program.

The staff determined through reviews, that the cracking 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) are not plausible aging effects due to the nonexistence of these aging mechanisms. The applicant states that cracking due to settlement is not an aging effect requiring management for concrete components below grade because the total and differential settlements experienced by the subject structures since plant construction are within permissible and anticipated limits. Based on settlement markers determined to be stable over a period of several decades, the unit one Settlement Monitoring Program was terminated circa 1995. For unit two, the Settlement Monitoring Program is an existing plant-specific program, and the evaluation is documented in Section 3.0.3.3.5. The applicant's technical staff also indicated that the Settlement Monitoring Program (unit two only) is credited with management of TLAA Section 4.7.5, which is associated with piping stress at penetrations into structures whose settlement has not stopped. The applicant also stated that the aging effects of reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete sub-foundations are not applicable to BVPS, because the four inch porous sub-foundation is above the groundwater table, a de-watering system is not used, and settlement was found acceptable. In addition, the applicant conservatively elected to use the Structural Monitoring Program to monitor the above-grade exposed containment concrete for the aging effect of cracking due to settlement. The staff reviewed the Structures Monitoring Program, and the evaluation is documented in Section 3.0.3.2.12. The staff finds that this program includes activities that are consistent with the recommendations in the GALL Report, and are adequate to manage cracks and distortion due to increased stress levels from settlement, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete sub-foundations.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.2 criteria. For those line items that apply to LRA Section 3.5.2.2.1.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature. Reduction of strength and modulus of concrete due to elevated temperatures could occur in concrete and steel containments. The staff confirmed that no portion of the concrete containment components at BVPS exceeds specified temperature limits, which are 150°F for general area and 200°F for local area. Therefore, this item is not applicable to BVPS.

Loss of Material due to General, Pitting and Crevice Corrosion. The staff reviewed LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4.

In LRA Section 3.5.2.2.1.4 the applicant addressed loss of material due to general, pitting and crevice corrosion for steel elements of accessible and inaccessible areas of containments, stating that the ASME Section XI, Subsection IWE and the 10 CFR 50 Appendix J Programs are recommended 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.

The staff's reviews of the applicant's ASME Section XI, Subsection IWE Program and 10 CFR 50 Appendix J Program are documented in SER Section 3.0.3.2.2 and SER Section 3.0.3.1.1, respectively.

During its review, the staff noted that a temporary construction opening for the Unit 1 steam generator and reactor head replacements in 2006 during the Cycle 17 Refueling Outage revealed degradation from the inaccessible side of the steel liner, for which the applicant could not identify a root-cause from the observations in the field or from the lab analysis. The staff issued RAI B.2.1-1, RAI B.2.1-2, RAI B.2.3-1, RAI B.2.3-2, B.2.3-3, dated May 8, 2008 for additional information. The applicant's responses and the staff's review are discussed and documented in SER Section 3.0.3.1.1 and SER Section 3.0.3.2.2.

On the basis of its review, the staff determines that loss of material due to general pitting and crevice corrosion is an aging effect for steel elements of accessible and inaccessible areas of containments. The staff finds that applicant's inspections and tests in accordance with the ASME Section XI, Subsection IWE Program and 10 CFR 50 Appendix J Program to manage loss of material due to general pitting and crevice corrosion are adequate because the aging effect has been effectively monitored and managed under the aforementioned programs. Therefore, the staff agrees that no additional plant-specific program is required.

Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature. BVPS Containments are reinforced concrete. The staff confirmed that there are no prestressed tendons associated with the BVPS Containment design. Therefore, loss of prestress forces due to relaxation, shrinkage, creep and elevated temperature is not an aging effect applicable to BVPS Containments.

Cumulative Fatigue Damage. Cumulative fatigue damage is addressed as a TLAA. SER Section 4.6.3 documents the staff's review of the applicant's evaluation of this TLAA.

Cracking due to Stress Corrosion Cracking (SCC). The staff reviewed LRA Section 3.5.2.2.1.7 against the criteria in SRP-LR Section 3.5.2.2.1.7.

SRP-LR Section 3.5.2.2.1.7 states that cracking due to SCC of stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds may occur in PWR containments.

In LRA Section 3.5.2.2.1.7, the applicant suggests that cracking due to SCC is not an applicable aging effect for the stainless steel penetration sleeves and bellows because these stainless steel components are not exposed to an aggressive environment. However, SCC of the dissimilar metal welds is not discussed in the LRA. To be susceptible to SCC, stainless steel must be subject to both high temperature (>140°F) and an aggressive chemical environment. The staff is not clear what temperature and chemical elements these components have experienced. Therefore, RAI 3.5.2.2-4 dated May 8, 2008, was issued to ask the applicant to: (1) confirm whether cracking due to SCC is an applicable aging effect for dissimilar metal welds or not, (2) provide the history of the highest temperature that stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds have experienced, and (3) demonstrate what chemical elements that would support SCC have been monitored/inspected to ensure a none aggressive chemical environment.

In its response dated June 16, 2008 to RAI 3.5.2.2-4, the applicant stated as follows:

1. “Cracking" is not an aging effect requiring management for dissimilar metal welds associated with the containment penetration bellows that are addressed in LRA Section 3.5.2.2.1.7, because the environment does not support cracking. FENOC used Electric Power Research Institute (EPRI) License Renewal documents 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools" (Mechanical Tools), Revision 4, and 1002950, "Aging Effects for Structures and Structural Components (Structural Tools)," Revision 1, as the primary aging effect references. FENOC considered stress corrosion cracking (SCC) to be an applicable aging effect for stainless steel, whether the material is used as a weld material or is the base material of a component, wherever applicable criteria are present. The stress required to support SCC may be either residual (e.g., due to fabrication, field installation, or welding), or may be due to operating conditions. Residual stresses are assumed to exist at levels that support SCC. EPRI Mechanical Tools identifies a threshold temperature of 140ºF, below which SCC is not considered an aging effect requiring management. The subject penetration bellows that are discussed in LRA Section 3.5.2.2.1.7 are associated with the Unit 1 Recirculation Spray River Water outlet piping. These components are normally isolated, and so remain at ambient temperature, and do not exceed the threshold temperature for SCC. The EPRI Mechanical Tools notes that significant chloride contamination may support SCC even at low temperatures, but conclude that industry operating experience data does not indicate that SCC of stainless steel is a significant aging effect in raw water environments. BVPS operating experience reviews did not identify cracking below the EPRI Mechanical Tools threshold temperature as an aging effect requiring management.

2. The subject penetration bellows that are discussed in LRA Section 3.5.2.2.1.7 correspond to the Unit 1 Recirculation Spray River Water outlet piping. These components are normally at ambient temperature, and do not exceed 140ºF (the threshold temperature for SCC). Operation with containment ambient air temperature exceeding 108ºF is prohibited by Technical Specifications, and operation with Ohio River water temperature exceeding 90°F is prohibited by Technical Specifications. These limitations provide assurance that the penetration bellows associated with the River Water System supply to the Unit 1 Recirculation Spray heat exchangers have remained well below 140ºF.

On the basis of its review, the staff determines that cracking due to SCC of stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds in the BVPS containment is not applicable to BVPS since the conditions necessary for SCC, both high temperature (>140°F) and exposure to an aggressive environment, do not simultaneously exist.

<u>Cracking due to Cyclic Loading</u>. The BVPS containment penetrations that experience significant cyclic loading have fatigue analyses that are evaluated as TLAAs. SER Section 4.3.1 “Class 1 Fatigue” and SER Section 4.6.3 “Containment Liner Penetration Fatigue” document the staff’s review of the applicant’s evaluation of these TLAAs.

<u>Loss of Material (Scaling, Cracking, and Spalling) Due to Freeze-Thaw</u>. SRP-LR Section 3.5.2.2.1.9 states that loss of material (scaling, cracking, and spalling) due to freeze-thaw could occur in PWR and BWR concrete containments.

BVPS is located in an area in which weathering conditions are considered severe. The applicant stated in the LRA that loss of material (spalling, scaling) and cracking due to freeze-thaw in concrete containments exposed to weather are aging effects requiring management at BVPS. The applicant also stated that it manages containment concrete exposed to weather with the applicant's ASME Section XI, Subsection IWL Program which is discussed and reviewed in Section 3.0.3.1.2. The applicant further stated that containment concrete structures at BVPS were designed, constructed, and inspected in accordance with applicable ACI and ASTM standards, which provide for a good quality, dense, well cured, and low permeability concrete.

For containment structures, the GALL recommends that (1) accessible areas: inspections performed in accordance with IWL will indicate the presence of loss of material (spalling, scaling) and surface cracking due to freeze-thaw; (2) inaccessible areas: evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557). Documented evidence confirms that where the existing concrete had air content of 3% to 6%, subsequent inspection did not exhibit degradation related to freeze-thaw. Such inspections should be considered a part of the evaluation.

The staff noted that BVPS concrete has air content of 3% to 8%, which exceeds the GALL recommendation of 3% to 6%. However, according to ACI 201.2R "Guide to Durable Concrete," for concrete exposed to freezing and thawing, air content of 4.5 to 7.5 is recommended for severe exposure, and air content of 3.5 to 6 is recommended for moderate exposure. In addition, tolerance on air content of ± 1.5 percent is allowed. The staff found that the BVPS concrete mix design addressed freeze-thaw damage potential by using entrained air and aggregate soundness for structures subject to freezing in the subgrade freeze zone and in water-tight structures.

On the basis of its review, the staff determines that the applicant's evaluation is acceptable because (1) applicant's ASME Section XI, Subsection IWL Program is used to manage the aging effect due to freeze-thaw for accessible areas, which agree with the GALL recommendation; and (2) air content of 3% to 8% at BVPS confirms the recommendation by ACI 201.2R for severe exposure.

<u>Cracking Due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability, Due to Leaching of Calcium Hydroxide</u>. SRP-LR Section 3.5.2.2.1.10 states that cracking due to expansion and reaction with aggregate, and the increase in porosity and permeability due to leaching of calcium hydroxide could occur in concrete elements of concrete and steel containments.

On the basis of its review, the staff determines that cracking due to expansion and reaction with aggregate are not aging effects for concrete elements of BVPS containments because the applicant's selection of nonreactive concrete aggregates based on testing is in accordance with ASTM C227-71 "Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)", and ASTM C289-71 "Potential reactivity of aggregates (Chemical Method)", which agree with the GALL recommendation of investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54 or ASTM C227-50, as described in NUREG-1557.

The applicant stated in the LRA that the increase in porosity and permeability due to leaching of calcium hydroxide is not an aging effect requiring management because BVPS concrete is designed in accordance with ACI 318 and constructed in accordance with ACI 301.

SRP Section 3.5.2.2.1.10 states: "The existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. The GALL Report recommends further evaluation if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77." The staff's discussion and review for the equivalence of BVPS concrete to the ACI 201.2R-77 recommendations is documented in SER Section 3.5.2.2.1.1. The staff reviewed the applicant's ASME Section XI, Subsection IWL Program, and the evaluation is documented in Section 3.0.3.1.2.

On the basis of its review, the staff agrees that cracking due to expansion and reaction with aggregate, increase in porosity and permeability due to leaching of calcium hydroxide are not plausible aging effects for concrete elements of containments because (1) the absence of the aging effects is confirmed under the Inservice Inspection (ISI) Program – IWL, (2) the material selection in accordance with ASTM standards ensures nonreactive concrete aggregates, and (3) leaching of calcium hydroxide from reinforced concrete becomes significant only if the concrete is exposed to flowing water. BVPS containment concrete is above the groundwater table and is not exposed to flowing water. Therefore, the staff determines that no further evaluation is required.

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

<u>Aging of Structures Not Covered by Structures Monitoring Program</u>. The staff reviewed LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

In LRA Section 3.5.2.2.2.1 the applicant stated that BVPS concrete structures subject to an AMR are included in the Structures Monitoring Program and supplemented by other AMPs as appropriate. This statement is true for concrete items even if the AMR specified no AERMs. Aging effects discussed below for structural steel items are also addressed by the structures monitoring program. Additional discussion of specific aging effects follows.

SRP-LR Section 3.5.2.2.2.1 states that the GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the structures monitoring programs, including (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; (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; (3) loss of material due to corrosion for Groups 1-5, 7, and 8 structures; (4) loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, and 7-9 structures; (5) cracking due to expansion and reaction with aggregates for Groups 1-5 and 7-9 structures; (6) cracks and distortion due to increased stress levels from settlement for Groups 1-3 and 5-9 structures; and (7) reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures. The GALL Report recommends further evaluation only for structure/aging effect combinations not within structures monitoring programs. In addition, lock-up due to wear may occur for Lubrite radial beam seats in BWR drywells, RPV support shoes for PWRs with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The existing program relies on the structures monitoring program or ASME

Code Section XI, Subsection IWF, to manage this aging effect. The GALL Report recommends further evaluation only for structure-aging effect combinations not within the Inservice Inspection (IWF) or Structures Monitoring Programs.

(1) Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel for Groups 1-5, 7, and 9 Structures

The staff reviewed item 1 in LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

The staff's reviews for the cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for inaccessible concrete areas of Containments and Groups 1-5, 7 and 9 Structures are documented in SER Sections 3.5.2.2.1.1 and 3.5.2.2.2.2.4, respectively. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. The staff confirmed that Groups 1-5, 7, and 9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(2) Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling) Due to Aggressive Chemical Attack for Groups 1-5, 7, and 9 Structures

The staff reviewed item 2 in LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

The staff's reviews for the increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack for inaccessible concrete areas of Containments and Groups 1-5, 7 and 9 Structures are documented in SER Sections 3.5.2.2.1.1 and 3.5.2.2.2.2.4, respectively. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. The staff confirmed that Groups 1-5, 7 and 9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(3) Loss of Material Due to Corrosion for Groups 1-5, 7, and 8 Structures

The staff reviewed item 3 in LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

The applicant stated in the LRA that loss of material due to corrosion for structural steel components is managed by the Structures Monitoring Program. Additionally, loss of material of steel components that provide a fire barrier is also managed by the Fire Protection Program.

The staff's review for the loss of material due to general, pitting and crevice corrosion for steel elements of containments is documented in SER Section 3.5.2.2.1.4. The staff's reviews of the Structures Monitoring Program and the Fire Protection Program are documented in SER Sections 3.0.3.2.12 and 3.0.3.2.5, respectively. The staff finds that Groups 1-5, 7, 8 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(4) Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1-3, 5, and 7- 9 Structures

The staff reviewed item 4 in LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

The staff's reviews for the loss of material (spalling, scaling) and cracking due to freeze-thaw for concrete containments, below–grade inaccessible concrete areas of Groups 1-3, 5, 7- 9 Structures, and below–grade inaccessible concrete areas of Groups 6 Structures are documented in SER Sections 3.5.2.2.1.9, 3.5.2.2.2.2.1 and 3.5.2.2.2.4.2, respectively. The staff confirmed that Groups 1-3, 5, 7- 9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(5) Cracking Due to Expansion and Reaction with Aggregates for Groups 1-5 and 7-9 Structures

The staff reviewed item 5 in LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

The staff's reviews for the cracking due to expansion and reaction with aggregates for concrete elements of containments and below-grade inaccessible areas of Groups 1-5 and 7-9 structures are documented in SER Sections 3.5.2.2.1.10 and 3.5.2.2.2.2.2, respectively. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. The staff finds that Groups 1-5, 7- 9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(6) Cracks and Distortion Due to Increased Stress Levels from Settlement for Groups 1-3 and 5-9 Structures

Based on settlement markers determined to be stable over a period of several decades, the Unit 1 Settlement Monitoring Program was terminated circa 1995. For Unit 2, the Settlement Monitoring Program is an existing plant-specific program, and the evaluation is documented in Section 3.0.3.3.5. The applicant's technical staff also indicated that the Settlement Monitoring Program (unit two only) is credited with management of TLAA Section 4.7.5, which is associated with piping stress at penetrations into structures whose settlement has not stopped. The staff determined through reviews that the cracks and distortion due to increased stress levels from settlement for Groups 1-3 and 5-9 structures are not plausible aging effects requiring management for concrete components below grade because the total and differential settlements experienced by the subject structures since plant construction are within permissible and anticipated limits.

(7) Reduction in Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundation for Groups 1-3 and 5-9 Structures

The staff determined through reviews that reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures may not be plausible aging effects due to the absence of these aging mechanisms. The applicant stated that the aging effects of reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for Group 1-3 and 5-9 structures are not applicable to BVPS, because the sub-foundation is above the groundwater table, a de-watering system is not used, and settlement was found acceptable. In addition, the applicant conservatively elected to use the Structural Monitoring Program to monitor the above-grade exposed containment concrete for the aging effect of cracking due to settlement. The staff reviewed the Structures Monitoring Program, and the evaluation is documented in Section 3.0.3.2.12. The staff finds that this program is consistent with the recommendations in the GALL Report, and is adequate to manage 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.

(8) Lockup Due to Wear for Lubrite® Radial Beam Seats in BWR Drywell and Other Sliding Support Surfaces

The staff reviewed item "Lock-up due to Wear" in LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

The staff finds that Lubrite plates are all in-scope of the applicant's ASME Section XI, Subsection IWF Program. The staff's review of the ASME Section XI, Subsection IWF Program is documented in SER Section 3.0.3.2.3. The applicant stated in LRA Section 3.5.2.2.2.1 that the ASME Section XI, Subsection IWF Program will perform inspections to confirm the absence of lock-up due to wear aging effect for these components. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.1. For those line items that apply to LRA Section 3.5.2.2.2.1, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Aging Management of Inaccessible Areas . The staff reviewed LRA Section 3.5.2.2.2.2 against the following criteria in SRP-LR Section 3.5.2.2.2.2:

(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.

The staff reviewed Item 1 of LRA Section 3.5.2.2.2.2 against the criteria in item 1 of SRP-LR Section 3.5.2.2.2.2.

The applicant stated in the LRA that aging of exterior surfaces of concrete and concrete fire barriers exposed to weather, exposed to raw water, or below grade is managed by the Structures Monitoring Program. Its interior surfaces are managed by the Structures Monitoring Program and the Fire Protection Program. The staff's reviews of the Structures Monitoring Program and the Fire Protection Program are documented in SER Sections 3.0.3.2.12 and 3.0.3.2.5, respectively.

On the basis of its review, the staff found that the BVPS concrete mix design adequately addressed freeze-thaw damage potential by using entrained air and aggregate soundness for structures subject to freezing in the subgrade freeze zone and in water-tight structures. The sufficient concrete air content creates a large number of closely spaced, small air bubbles in the hardened concrete. The air bubbles relieve the pressure build-up caused by ice formation by acting as expansion chambers, therefore no additional plant-specific program is required for below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The staff finds this acceptable because it is in agreement with the recommendations in the GALL Report for concrete exposed to freezing and thawing.

(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.

The staff reviewed Item 2 of LRA Section 3.5.2.2.2.2 against the criteria in item 2 of SRP-LR Section 3.5.2.2.2.2. On the basis of its review, the staff determines that cracking due to expansion and reaction with aggregate in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures are not aging effects because selection of nonreactive concrete aggregates based on testing is in accordance with ASTM C227-71 “Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method),’ and ASTM C289-71 “Potential reactivity of aggregates (Chemical Method),’ which agree with the GALL recommendation of investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54 or ASTM C227-50, as described in NUREG-1557.

(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.

The staff determined through reviews that cracks and distortion due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures are not plausible aging effects due to the absence of these aging mechanisms. The applicant stated that although the containment building foundation is supported on a porous concrete subfoundation, the subfoundation is located above the normal groundwater level and is not subject to erosion. Outside of the containments, none of the BVPS structures in the scope of license renewal have porous subfoundations. Therefore, erosion of cement from the porous concrete subfoundation is not an effect requiring management. In addition, the applicant elected the Structural Monitoring Program to monitor the above-grade exposed containment concrete for the aging effect of cracking due to settlement. The staff reviewed the Structures Monitoring Program, and the evaluation is documented in SER Section 3.0.3.2.12. The staff finds that this program is consistent with the recommendations in the GALL Report, and is adequate to manage 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.

(4) Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures.

Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures.

The staff reviewed Item 4 of LRA Section 3.5.2.2.2.2 against the criteria in item 4 of SRP-LR Section 3.5.2.2.2.2, which addresses two areas:

(1) Increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack.

The applicant stated in the LRA that the loss of material and change in material properties due to aggressive chemical attack is not an aging effect requiring management at BVPS because (1) groundwater analyses confirm that the BVPS site groundwater is not aggressive, and (2) BVPS concrete is designed in accordance with ACI 318 and constructed in accordance with ACI 301, which enhances the resistance to chemical attack through the use of dense concrete that has low permeability and a low water to cement ratio.

The GALL Report recommends the periodic groundwater inspection for chlorides, sulfates, and pH to ensure non-aggressive groundwater chemistries. The staff's review of the applicant's groundwater inspection program and its comparison to the GALL Report recommendations are documented in SER Section 3.5.2.2.1.1.

The GALL Report also suggests that concrete is constructed in accordance with the recommendations in ACI 201.2R-77 for a quality concrete. The staff's discussion and review for the equivalence of BVPS concrete to the ACI 201.2R-77 recommendations is documented in SER Section 3.5.2.2.1.1.

On the basis of its review, the staff finds that the increases in porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures require no further evaluation of plant-specific programs because the environment is not aggressive and the inspection frequency of groundwater chemistries under the applicant's Structures Monitoring Program agrees with the recommendation of GALL Report for groundwater monitoring. However the staff does not agree with the applicant that the loss of material and change in material properties due to aggressive chemical attacks is not an aging effect requiring management. This is discussed further in SER Section 3.5.2.2-1.

(2) Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel.

The applicant stated in the LRA that the cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures is not an aging effect requiring management at BVPS because (1) groundwater analyses confirm that the BVPS site groundwater is not aggressive, and (2) the design and construction of the BVPS concrete structures in accordance with ACI 318 and ACI 301 generally prevent corrosion of embedded steel from occurring.

The GALL Report recommends the periodic groundwater inspection for chlorides, sulfates, and pH to ensure non-aggressive groundwater chemistries. The staff's review of the applicant's groundwater inspection program and its comparison to the GALL Report recommendations are documented in SER Section 3.5.2.2.1.1.

The GALL Report also suggests that concrete is constructed in accordance with the recommendations in ACI 201.2R-77 for a quality concrete. The staff's discussion and review for the equivalence of BVPS concrete to the ACI 201.2R-77 recommendations is documented in SER Section 3.5.2.2.1.1, including discussion of operating experience reported under the ASME Section XI, Subsection IWL.

The staff has reviewed the LRA and the additional information provided by the applicant by letter dated June 16, 2008. On the basis of its review, the staff finds that the cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures require no further evaluation of plant-specific programs because the environment is not aggressive and the inspection frequency of groundwater chemistries under the applicant's Structures Monitoring Program agrees with the recommendation of GALL Report for groundwater monitoring. However, the staff does not agree with the applicant that corrosion of embedded steel is not an aging effect requiring management. This is discussed further in SER Section 3.5.2.2.1.1.

(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

The applicant claimed in the LRA that an increase in porosity and permeability due to leaching of calcium hydroxide in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures is not an aging effect requiring management because BVPS concrete is designed in accordance with ACI 318 and constructed in accordance with ACI 301.

SRP Section 3.5.2.2.1.10 states: "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. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these Groups of structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77." The staff's discussion and review for the equivalence of BVPS concrete to the ACI 201.2R-77 recommendations is documented in SER Section 3.5.2.2.1.1.

On the basis of its review, the staff finds that increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures is not a plausible aging effect requiring management because the design and construction of Groups 1-3, 5, and 7-9 concrete structures in accordance with ACI codes enhances resistance to leaching.

<u>Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature</u>. The staff reviewed LRA Section 3.5.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.3.

In LRA Section 3.5.2.2.2.3 the applicant addresses reduction of concrete strength and modulus due to elevated temperatures that may occur in PWR and BWR Groups 1-5 concrete structures. The applicant stated that the GALL Report item for concrete degradation from temperature elevations does not apply because ambient temperatures for the containment internals and the concrete components for other structures do not exceed specified temperature limits. In all locations the temperatures are well below the limits. Hot piping penetrations have cooling systems to keep concrete temperature below the threshold.

SRP-LR Section 3.5.2.2.2.3 states that reduction of strength and modulus of concrete due to elevated temperatures may occur in PWR and BWR Groups 1-5 concrete structures. For concrete elements that exceed specified temperature limits, further evaluations are recommended. Appendix A to ACI 349-85 specifies the concrete temperature limits for normal operation or any other long-term period. Temperatures shall not exceed 150°F except for local areas allowed to have temperatures not to exceed 200°F.

The staff confirmed from the BVPS LRA that no portion of Groups 1-5 concrete structures exceed specified temperature limits, which are 150°F for general area and 200°F for local area. Therefore, this item is not applicable to BVPS.

Aging Management of Inaccessible Areas for Group 6 Structures. The staff reviewed LRA Section 3.5.2.2.2.4 against the following criteria in SRP-LR Section 3.5.2.2.2.4:

(1) Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due 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.

The staff reviewed Item 1 of LRA Section 3.5.2.2.2.4 against the criteria in item 1 of SRP-LR Section 3.5.2.2.2.4, which addresses two areas:

(1) Increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack

The applicant stated in the LRA that the loss of material and change in material properties due to aggressive chemical attack is not an aging effect requiring management at BVPS for below-grade inaccessible concrete areas of Group 6 structures because (1) groundwater analyses confirm that the BVPS site groundwater is not aggressive, and (2) BVPS concrete is designed in accordance with ACI 318 and constructed in accordance with ACI 301, which enhances the resistance to chemical attack through the use of dense concrete that has low permeability and a low water to cement ratio.

The GALL Report recommends the periodic groundwater inspection for chlorides, sulfates, and pH to ensure non-aggressive groundwater chemistries. The staff's review of the applicant's groundwater inspection program and its comparison to the GALL Report recommendations are documented in SER Section 3.5.2.2.1.1.

The GALL Report also suggests that concrete is constructed in accordance with the recommendations in ACI 201.2R-77 for a quality concrete. The staff's discussion and review for the equivalence of BVPS concrete to the ACI 201.2R-77 recommendations is documented in SER Section 3.5.2.2.1.1.

On the basis of its review, the staff finds that the increases in porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack in below-grade inaccessible concrete areas of Group 6 structures require no further evaluation of plant-specific programs because the environment is not aggressive and the inspection frequency of groundwater chemistries under the applicant's Structures Monitoring Program agrees with the recommendation of GALL Report for groundwater monitoring. However the staff does not agree with the applicant that the loss of material and change in material properties due to aggressive chemical attacks is not an aging effect requiring management. This is discussed further in SER Section 3.5.2.2.1.1.

(2) Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel.

The applicant stated in the LRA that the cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel in below-grade inaccessible concrete areas of Groups 6 structures is not an aging effect requiring management at BVPS because (1) groundwater analyses confirm that the BVPS site groundwater is not aggressive, and (2) the design and construction of the BVPS concrete structures in accordance with ACI 318 and ACI 301 generally prevent corrosion of embedded steel from occurring.

The GALL Report recommends the periodic groundwater inspection for chlorides, sulfates, and pH to ensure non-aggressive groundwater chemistries. The staff's review of the applicant's groundwater inspection program and its comparison to the GALL Report recommendations are documented in SER Section 3.5.2.2.1.1.

The GALL Report also suggests that concrete is constructed in accordance with the recommendations in ACI 201.2R-77 for a quality concrete. The staff's discussion and review for the equivalence of BVPS concrete to the ACI 201.2R-77 recommendations is documented in SER Section 3.5.2.2.1.1, including discussion of operating experience reported under the ASME Section XI, Subsection IWL AMP.

The Staff has reviewed the LRA and the additional information provided by the applicant by letter dated June 16, 2008. On the basis of its review, the staff finds that the cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel in below-grade inaccessible concrete areas of Groups 6 structures require no further evaluation of plant-specific programs because the environment is not aggressive and the inspection frequency of groundwater chemistries under the applicant's Structures Monitoring Program agrees with the recommendation of GALL Report for groundwater monitoring. However, the staff does not agree with the applicant that corrosion of embedded steel is not an aging effect requiring management. This is discussed further in SER Section 3.5.2.2.1.1.

(2) Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below grade inaccessible concrete areas of Group 6 structures.

The staff reviewed Item 2 of LRA Section 3.5.2.2.2.4 against the criteria in Item 2 of SRP-LR Section 3.5.2.2.2.4.

The applicant stated in the LRA that the Structures Monitoring Program manages this aging effect for concrete exposed to weather in the Intake, Alternate Intake, and Unit 2 Emergency Outfall Structures. The staff's review of the Structures Monitoring Program is documented in SER Sections 3.0.3.2.12.

On the basis of its review, the staff found that the BVPS concrete mix design addressed freeze-thaw damage potential by using entrained air and aggregate soundness for structures subject to freezing in the subgrade freeze zone and in water-tight structures. The sufficient concrete air content creates a large number of closely spaced, small air bubbles in the hardened concrete. The air bubbles relieve the pressure build-up caused by ice formation by acting as expansion chambers, therefore no additional plant-specific program is required for below-grade inaccessible concrete areas of Groups 6 structures. The staff finds this acceptable because it is in agreement with the recommendations in the GALL Report for concrete exposed to freezing and thawing.

(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.

On the basis of review, the staff agrees that cracking due to expansion and reaction with aggregate are not aging effects for BVPS concrete areas of Group 6 structures because selection of nonreactive concrete aggregates based on testing is in accordance with ASTM C227-71, "Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)," and ASTM C289-71, "Potential reactivity of aggregates (Chemical Method)," which agree with the GALL recommendation of investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54 or ASTM C227-50, as described in NUREG-1557.

The applicant claimed in the LRA that an increase in porosity and permeability due to leaching of calcium hydroxide is not an aging effect requiring management because BVPS concrete is designed in accordance with ACI 318 and constructed in accordance with ACI 301. However, GALL Report suggests that concrete is constructed in accordance with the recommendations in ACI 201.2R. The staff's discussion and review for the equivalence of BVPS concrete to the ACI 201.2R recommendations is documented in SER Section 3.5.2.2.1.1.

On the basis of its review, the staff finds that increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide in below grade inaccessible reinforced concrete areas of Group 6 structures is not a plausible aging effect requiring management because the design and construction of Group 6 concrete structures in accordance with ACI codes enhances resistance to leaching.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4. For those line items that apply to LRA Section 3.5.2.2.2.4, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Cracking due to Stress Corrosion Cracking and Loss of Material due to Pitting and Crevice Corrosion. Cracking due to stress corrosion cracking and loss of material due to pitting and crevice corrosion could occur for Group 7 and 8 stainless steel tank liners exposed to standing water.

On the basis of its review, the staff confirmed that BVPS has no in-scope stainless steel tank liners exposed to standing water. Therefore, this item is not applicable to BVPS.

Aging of Supports Not Covered by Structures Monitoring Program. The GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the Structures Monitoring Program. The staff reviewed LRA Section 3.5.2.2.2.6 against the criteria in SRP-LR Section 3.5.2.2.2.6.

The staff has reviewed the applicable Section of the applicant's LRA. The staff confirmed that all the component support/aging effect combinations of (1) loss of material due to general and pitting corrosion, for Groups B2-B5 supports; (2) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports; are managed by the Structures Monitoring Program. Therefore, the staff determines that no further evaluation is required.

Cumulative Fatigue Damage due to Cyclic Loading. The staff reviewed LRA Section 3.5.2.2.2.7 against the criteria in SRP-LR Section 3.5.2.2.2.7. The staff has reviewed the applicable Section of the applicant's LRA. The staff confirmed that no fatigue analyses were identified as TLAAs because no CLB fatigue analysis exists for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3. Therefore, cumulative fatigue damage of component is not a TLAA as defined in 10 CFR 54.3.

3.5.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In the applicant's LRA Tables 3.5.2-1 through 3.5.2-36, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.5.2-1 through 3.5.2-36, the applicant indicated, via notes F through J, which the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.5.2.3.1 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Alternate Intake Structure (Common) – LRA Table 3.5.2-1

The staff reviewed LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the alternate intake structure (common) component groups.

In LRA Table 3.5.2-1, the applicant identified 18 unique component/material/environment/aging effect/AMP groups for the Alternate Intake Structure. Thirteen have AMR results consistent with the GALL Report, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Report Volume II line items are appropriate.

For five groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports – Alternate Intake Structure (Common) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2 Containments, Structures, and Component Supports – Summary of Aging Management Evaluation - Auxiliary Building – LRA Table 3.5.2-2

The staff reviewed LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the auxiliary building component groups.

In LRA Table 3.5.2-2, the applicant identified 36 unique component/material/environment/aging effect/AMP groups for the Auxiliary Building. Twenty six have AMR results consistent with the GALL Report, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Report Volume II line items are appropriate.

For ten groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states “No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation.” The staff disagrees with the applicant’s AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports – Summary of Aging Management Evaluation - Auxiliary Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.3 Containments, Structures, and Component Supports – Summary of Aging Management Evaluation - Boric Acid Tank Building (Unit 1 only) – LRA Table 3.5.2-3

The staff reviewed LRA Table 3.5.2-3, which summarizes the results of AMR evaluations for the boric acid tank building component groups.

In LRA Table 3.5.2-3, the applicant identified six unique component/material/environment/aging effect/AMP groups for the Boric Acid Tank Building. Five have AMR results consistent with the GALL Report, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Report Volume II line items are appropriate.
For one group, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff’s review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. This line item references Note I and plant-specific Note 501, which states “No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation.” The staff disagrees with the applicant’s AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports – Summary of Aging Management Evaluation - Boric Acid Tank Building (Unit 1 only) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.4 Containments, Structures, and Component Supports – Summary of Aging Management Evaluation - Cable Tunnel – LRA Table 3.5.2-4

The staff reviewed LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the cable tunnel component groups.

In LRA Table 3.5.2-4, the applicant identified eight unique component/material/environment/aging effect/AMP groups for the Cable Tunnel. All eight of these groups reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." For these groups the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports – Summary of Aging Management Evaluation - Cable Tunnel not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.5 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Chemical Addition Building (Unit 1 only) – LRA Table 3.5.2-5

The staff reviewed LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the chemical addition building component groups.

In LRA Table 3.5.2-5, the applicant identified five unique component/material/environment/aging effect/AMP groups for the Chemical Addition Building. All five have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Chemical Addition Building (Unit 1 only) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.6 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Condensate Polishing Building (Unit 2 only) – LRA Table 3.5.2-6

The staff reviewed LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the condensate polishing building (unit 2 only) component groups.

In LRA Table 3.5.2-6, the applicant identified eight unique component/material/environment /aging effect/AMP groups for the Condensate Polishing Building. Four have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For four groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Condensate Polishing Building (Unit 2 only) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.7 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Control Building (Unit 2 only) – LRA Table 3.5.2-7

The staff reviewed LRA Table 3.5.2-7, which summarizes the results of AMR evaluations for the control building (unit 2 only) component groups.

In LRA Table 3.5.2-7, the applicant identified 18 unique component/material/environment /aging effect/AMP groups for the Control Building (Unit 2). Fourteen have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For four groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Control Building (Unit 2 only) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.8 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Decontamination Building – LRA Table 3.5.2-8

The staff reviewed LRA Table 3.5.2-8, which summarizes the results of AMR evaluations for the decontamination building component groups.

In LRA Table 3.5.2-8, the applicant identified 12 unique component/material/environment /aging effect/AMP groups for the Decontamination Building. Nine have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For three groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Decontamination Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.9 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Diesel Generator Building – LRA Table 3.5.2-9

The staff reviewed LRA Table 3.5.2-9, which summarizes the results of AMR evaluations for the diesel generator building component groups.

In LRA Table 3.5.2-9, the applicant identified 21 unique component/material/environment /aging effect/AMP groups for the Diesel Generator Building. Sixteen have AMR results consistent with

GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For five groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to the appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Diesel Generator Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.10 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Emergency Outfall Structure (Unit 2 only) – LRA Table 3.5.2-10

The staff reviewed LRA Table 3.5.2-10, which summarizes the results of AMR evaluations for the emergency outfall structure (unit 2 only) component groups.

In LRA Table 3.5.2-10, the applicant identified four unique component/material/environment/aging effect/AMP groups for the Emergency Outfall Structure. Two have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Emergency Outfall Structure (Unit 2 only) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.11 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Emergency Response Facility Diesel Generator Building (Common) – LRA Table 3.5.2-11

The staff reviewed LRA Table 3.5.2-11, which summarizes the results of AMR evaluations for the emergency response facility diesel generator building (common) component groups.

In LRA Table 3.5.2-11, the applicant identified eight unique component/material/environment/aging effect/AMP groups for the Emergency Response Facility Diesel Generator Building. Five have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For three groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Emergency Response Facility Diesel Generator Building (Common) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.12 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Emergency Response Facility Substation Building (Common) – LRA Table 3.5.2-12

The staff reviewed LRA Table 3.5.2-12, which summarizes the results of AMR evaluations for the emergency response facility substation building (common) component groups.

In LRA Table 3.5.2-12, the applicant identified 11 unique component/material/environment/aging effect/AMP groups for the Emergency Response Facility Substation Building. Seven have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For four groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Emergency Response Facility Substation Building (Common) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.13 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Equipment Hatch Platform – LRA Table 3.5.2-13

The staff reviewed LRA Table 3.5.2-13, which summarizes the results of AMR evaluations for the equipment hatch platform component groups.

In LRA Table 3.5.2-13, the applicant identified 10 unique component/material/environment/aging effect/AMP groups for the Equipment Hatch Platform. Four have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For six groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Equipment Hatch Platform not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.14 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Fuel Building – LRA Table 3.5.2-14

The staff reviewed LRA Table 3.5.2-14, which summarizes the results of AMR evaluations for the fuel building component groups.

In LRA Table 3.5.2-14, the applicant identified 36 unique component/material/environment/aging effect/AMP groups for the Fuel Building. Twenty three have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For seven groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

The six remaining groups reference Note I and the applicant proposed to manage the loss of material aging effect on stainless steel material (item 3.5.1-46) by using the Water Chemistry Program. The staff's review of the Water Chemistry Program is documented in SER Section 3.0.3.2.14. The staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Fuel Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.15 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Gaseous Waste Storage Vault – LRA Table 3.5.2-15

The staff reviewed LRA Table 3.5.2-15, which summarizes the results of AMR evaluations for the gaseous waste storage vault component groups.

In LRA Table 3.5.2-15 the applicant identified 11 unique component/material/environment/ aging effect/AMP groups for the Gaseous Waste Storage Vault. Five have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For six groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Gaseous Waste Storage Vault not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.16 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Guard House – LRA Table 3.5.2-16

The staff reviewed LRA Table 3.5.2-16, which summarizes the results of AMR evaluations for the guard house component groups.

In LRA Table 3.5.2-16, the applicant identified seven unique component/material/environment/aging effect/AMP groups for the Guard House. Six have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For one group, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. This line item references Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Guard House not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.17 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Intake Structure (Common) – LRA Table 3.5.2-17

The staff reviewed LRA Table 3.5.2-17, which summarizes the results of AMR evaluations for the intake structure (common) component groups.

In LRA Table 3.5.2-17, the applicant identified 24 unique component/material/environment/aging effect/AMP groups for the Intake Structure. Nineteen have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For five groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Intake Structure (Common) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.18 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Main Steam and Cable Vault – LRA Table 3.5.2-18

The staff reviewed LRA Table 3.5.2-18, which summarizes the results of AMR evaluations for the main steam and cable vault component groups.

In LRA Table 3.5.2-18, the applicant identified 37 unique component/material/environment/aging effect/AMP groups for the Main Steam and Cable Vault. Twenty six have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For 11 groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Main Steam and Cable Vault not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.19 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Pipe Tunnel – LRA Table 3.5.2-19

The staff reviewed LRA Table 3.5.2-19, which summarizes the results of AMR evaluations for the pipe tunnel component groups.

In LRA Table 3.5.2-19, the applicant identified nine unique component/material/environment/aging effect/AMP groups for the Pipe Tunnel. Three have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For six groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Pipe Tunnel not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.20 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Primary Demineralized Water Storage Tank Pad and Enclosure – LRA Table 3.5.2-20

The staff reviewed LRA Table 3.5.2-20, which summarizes the results of AMR evaluations for the primary demineralized water storage tank pad and enclosure component groups.

In LRA Table 3.5.2-20, the applicant identified 18 unique component/material/environment/aging effect/AMP groups for the Primary Demineralized Water Storage Tank Pad and Enclosure. Twelve have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For five groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

During its review, the staff noted that for Item 1 of LRA Table 3.5.2-20, pile component type, carbon steel material, and below grade environment, the applicant indicates that no aging effect requires management and therefore no AMP is applied. Notes G and 512 are used for this line item. Note 512 states "Pipe piles driven in soils have been shown to be unaffected by corrosion." However, Note 526 states "Pipe piles driven into disturbed soils have been shown to experience only minor to moderate corrosion." A RAI 3.5.2.3-1, dated May 8, 2008, was issued to ask the applicant to justify why corrosion is not an aging effect for carbon steel material in below grade environment. Further, the applicant was asked to explain how to monitor/inspect the factors of soil aggressiveness that would support pipe pile corrosion, if the pipe piles are vulnerable to corrosion.

In its response dated June 16, 2008, the applicant stated the conclusion that corrosion of pipe pile is not an aging effect requiring management is based on the EPRI 1002950, "Aging Effects for Structures and Structural Components (Structural Tools)," Revision 1, Section 5.3.1.5.

On the basis of its review of the applicant's response to RAI 3.5.2.3-1 and EPRI 1002950, Revision 1, Section 5.3.1.5, the staff finds that corrosion of pile pipe is not an aging effect requiring management to be acceptable because of the industry study of corrosion data from 43 piling installations indicating that steel piles were not appreciably affected by corrosion in undisturbed or disturbed natural soil. Therefore, the staff's concern described in RAI 3.5.2.3-1 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Primary Demineralized Water Storage Tank Pad and Enclosure not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.21 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Primary Water Storage Building (Unit 1 only) – LRA Table 3.5.2-21

The staff reviewed LRA Table 3.5.2-21, which summarizes the results of AMR evaluations for the primary water storage building (unit 1 only) component groups.

In LRA Table 3.5.2-21, the applicant identified six unique component/material/environment/aging effect/AMP groups for the Primary Water Storage Building. Three have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For three groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Primary Water Storage Building (Unit 1 only) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.22 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Reactor Containment Building – LRA Table 3.5.2-22

The staff reviewed LRA Table 3.5.2-22, which summarizes the results of AMR evaluations for the reactor containment building component groups.

In LRA Table 3.5.2-22, the applicant identified 120 unique component/material/environment/aging effect/AMP groups for the Reactor Containment Building. Eighty four have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For twenty groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For nine groups, the applicant proposed to manage stainless steel material, aging effect loss of material, by using the Water Chemistry Program. The staff's review of the Water Chemistry Program is documented in SER Section 3.0.3.2.14. These line items reference Note I. The staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For three groups, the applicant proposed to manage stainless steel material, aging effect none, by using the 10 CFR Part 50 Appendix J Program. The staff's review of the 10 CFR Part 50 Appendix J Program is documented in SER Section 3.0.3.1.1. The 10 CFR Part 50 Appendix J Program description stated that periodic surveillance of reactor containment penetrations and isolation valves is performed so that proper maintenance and repairs are made during the service life of containment, and systems and components penetrating primary containment. The staff found that, since these components will be inspected through plant procedures the aging effect on stainless steel material is effectively managed using 10 CFR Part 50 Appendix J Program

For two groups, the applicant proposed to manage lubrite material (item 3.5.1-56); aging effect none, by using the ASME Section XI, Subsection IWF Program. The staff's review of the applicant's ASME Section XI, Subsection IWF Program is documented in SER Section 3.0.3.2.3. The ASME Section XI, Subsection IWF Program description stated the program is implemented through plant procedures, which provide for visual examination of inservice inspection of Class 1, 2 and 3 and MC component supports. The staff found that, since these components will be visually inspected through plant procedures at least every refueling-outage, the aging effect on lubrite material is effectively managed using ASME Section XI, Subsection IWF Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Reactor Containment Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.23 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Refueling Water Storage Tank and Chemical Addition Tank Pad and Surroundings – LRA Table 3.5.2-23

The staff reviewed LRA Table 3.5.2-23, which summarizes the results of AMR evaluations for refueling water storage tank and chemical addition tank pad and surroundings component groups.

In LRA Table 3.5.2-23, the applicant identified eight unique component/material/environment/aging effect/AMP groups for the Refueling Water Storage Tank and Chemical Addition Tank Pad. Six have AMR results consistent with GALL, as identified by reference to Notes A through

E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Refueling Water Storage Tank and Chemical Addition Tank Pad and Surroundings not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.24 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Relay Building (Common) – LRA Table 3.5.2-24

The staff reviewed LRA Table 3.5.2-24, which summarizes the results of AMR evaluations for relay building (common) component groups.

In LRA Table 3.5.2-24, the applicant identified 11 unique component/material/environment/aging effect/AMP groups for the Relay Building. Eight have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For three groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Relay Building (common) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.25 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Safeguards Building – LRA Table 3.5.2-25

The staff reviewed LRA Table 3.5.2-25, which summarizes the results of AMR evaluations for safeguards building component groups.

In LRA Table 3.5.2-25, the applicant identified 28 unique component/material/environment/aging effect/AMP groups for the Safeguards Building. Seventeen have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For nine groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

During its review, the staff noted that for Items 1 and 15 of LRA Table 3.5.2-25, pump casement component type, carbon steel material, and below grade environment, the applicant indicates that no aging effect requires management and therefore no AMP is applied. Note G is used for these line items. However, carbon steel is susceptible to corrosion in soil. In RAI 3.5.2.3-2, dated May 8, 2008, the staff requested that the applicant justify why corrosion is not an aging effect for carbon steel material in below grade environments for the pump casement component.

In its response dated June 16, 2008, the applicant stated the reason that corrosion of casements is not an aging effect requiring management is due to the similarity of the basis for pipe piles described in the RAI 3.5.2.3-1, which is based on the EPRI 1002950, "Aging Effects for Structures and Structural Components (Structural Tools)," Revision 1, Section 5.3.1.5.

On the basis of its review of the applicant's response to RAI 3.5.2.3-2 and EPRI 1002950, Revision 1, Section 5.3.1.5, the staff finds that corrosion of casement is not an aging effect requiring management to be acceptable because of the industry study of corrosion data from 43 piling installations indicating that steel piles were not appreciably affected by corrosion in undisturbed and disturbed natural soil. Therefore, the staff's concern described in RAI 3.5.2.3-2 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Safeguards Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.26 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Service Building – LRA Table 3.5.2-26

The staff reviewed LRA Table 3.5.2-26, which summarizes the results of AMR evaluations for service building component groups.

In LRA Table 3.5.2-26, the applicant identified 34 unique component/material/environment/aging effect/AMP groups for the Service Building. Twenty four have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For ten groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Service Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.27 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Solid Waste Building (Unit 1 Only) – LRA Table 3.5.2-27

The staff reviewed LRA Table 3.5.2-27, which summarizes the results of AMR evaluations for solid waste building (Unit 1) component groups.

In LRA Table 3.5.2-27, the applicant identified 10 unique component/material/environment/aging effect/AMP groups for the Solid Waste Building. Six have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For four groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Solid Waste Building (Unit 1 Only) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.28 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – South Office and Shop Building (Common) – LRA Table 3.5.2-28

The staff reviewed LRA Table 3.5.2-28, which summarizes the results of AMR evaluations for south office and shop building (common) component groups.

In LRA Table 3.5.2-28, the applicant identified four unique component/material/environment/aging effect/AMP groups for the South Office and Shop Building. Three have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For one group, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – South Office and Shop Building (Common) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.29 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Steam Generator Drain Tank Structure (Unit -1 only) – LRA Table 3.5.2-29

The staff reviewed LRA Table 3.5.2-29, which summarizes the results of AMR evaluations for steam generator drain tank structure (unit 1 only) component groups.

In LRA Table 3.5.2-29, the applicant identified four unique component/material/environment/ aging effect/AMP groups for the Steam Generator Drain Tank Structure. Two have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Steam Generator Drain Tank Structure (Unit -1 only) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.30 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Switchyard (Common) – LRA Table 3.5.2-30

The staff reviewed LRA Table 3.5.2-30, which summarizes the results of AMR evaluations for switchyard (common) component groups.

In LRA Table 3.5.2-30, the applicant identified four unique component/material/environment/ aging effect/AMP groups for the Switchyard. One has AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For one group, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable. For two groups, the applicant proposed to manage treated wood material; aging effect is loss of material and change of material properties by using the Electrical Wooden Poles/Structures Inspection Program (Unit 2 only). The staff reviewed the Electrical Wooden Poles/Structures Inspection Program (Unit 2 only), and its evaluation is documented in SER Section 3.0.3.3.2. On the basis of its review of the applicant's program, aging effects, and plant-specific and industry operating experience, the staff found that, since these components will be visually inspected, the aging effect of loss of material is effectively managed using the Electrical Wooden Poles/Structures Inspection Program (Unit 2 only).

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Switchyard (Common) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.31 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Turbine Building – LRA Table 3.5.2-31

The staff reviewed LRA Table 3.5.2-31, which summarizes the results of AMR evaluations for turbine building component groups.

In LRA Table 3.5.2-31, the applicant identified 17 unique component/material/environment/aging effect/AMP groups for the Turbine Building. Twelve have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For five groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Turbine Building not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.32 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Valve Pit – LRA Table 3.5.2-32

The staff reviewed LRA Table 3.5.2-32, which summarizes the results of AMR evaluations for valve pit component groups.

In LRA Table 3.5.2-32, the applicant identified 12 unique component/material/environment/aging effect/AMP groups for the Valve Pit. Five have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For seven groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Valve Pit not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.33 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Waste Handling Building (Unit 2 only) – LRA Table 3.5.2-33

The staff reviewed LRA Table 3.5.2-33, which summarizes the results of AMR evaluations for waste handling building (unit 2 only) component groups.

In LRA Table 3.5.2-33, the applicant identified nine unique component/material/environment/aging effect/AMP groups for the Waste Handling Building. Five have AMR results consistent with GALL, as identified by reference to Notes A through E.

The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For four groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Waste Handling Building (Unit 2 only) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.34 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Water Treatment Building (Unit -1 only) – LRA Table 3.5.2-34

The staff reviewed LRA Table 3.5.2-34, which summarizes the results of AMR evaluations for water treatment building (unit 1 only) component groups.

In LRA Table 3.5.2-34, the applicant identified six unique component/material/environment/aging effect/AMP groups for the Water Treatment Building. Four have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For two groups, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. These line items reference Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Water Treatment Building (Unit -1 only) not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.35 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Yard Structures – LRA Table 3.5.2-35

The staff reviewed LRA Table 3.5.2-35, which summarizes the results of AMR evaluations for yard structures component groups.

In LRA Table 3.5.2-35, the applicant identified five unique component/material/environment/aging effect/AMP groups for the Yard Structures. Three have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

For one group, the applicant proposed to manage concrete material, aging effect none, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. This line item references Note I and plant-specific Note 501, which states "No applicable aging effects have been identified for the component. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff disagrees with the applicant's AMR conclusion that there are no aging effects requiring management for the period of extended operation for these groups. However, the staff finds that the credited AMP is appropriate in each case. Since the applicant has committed to appropriate aging management programs for the period of extended operation, the staff finds these AMR results to be acceptable.

For another group, the applicant proposed to manage aluminum material, aging effect cracking, by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.12. This line item references Note H

On the basis of its review of the applicant's program, aging effects, and plant-specific and industry operating experience, the staff found that, since these components will be visually inspected at least once every five years, the aging effect of cracking is effectively managed using the Structures Monitoring Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Yard Structures not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.36 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Bulk Structural Commodities – LRA Table 3.5.2-36

The staff reviewed LRA Table 3.5.2-36, which summarizes the results of AMR evaluations for bulk structural commodities component groups.

In LRA Table 3.5.2-36, the applicant identified 259 unique component/material/environment/aging effect/AMP groups for Bulk Structural Commodities. Two hundred and forty two have AMR results consistent with GALL, as identified by reference to Notes A through E. The staff confirmed that the references to Table 1 and GALL Volume II line items are appropriate.

The applicant proposed to manage aluminum material; aging effect cracking, by using the Structures Monitoring Program. The staff reviewed the Structures Monitoring Program, and its evaluation is documented in SER Section 3.0.3.2.12. On the basis of its review of the applicant's program, aging effects, and plant-specific and industry operating experience, the staff found that, since these components will be visually inspected at least once every five years, the aging effect of cracking is effectively managed using the Structures Monitoring Program.

The applicant proposed to manage concrete material; aging effect is none by using the Structures Monitoring Program. On the basis of its review of the applicant's program, aging effects, and plant-specific and industry operating experience, the staff found that, since these components will be visually inspected at least once every five years, the aging effect on concrete material is effectively managed using the Structures Monitoring Program.

The applicant proposed to manage copper material; aging effect is loss of material by using the Structures Monitoring Program. On the basis of its review of the applicant's program, aging effects, and plant-specific and industry operating experience, the staff found that, since these components will be visually inspected at least once every five years, the aging effect of loss of material is effectively managed using the Structures Monitoring Program.

The applicant proposed to manage concrete block, fiberboard, calcium silicate and similar materials; aging effect is none by using the Fire Protection Program. The staff reviewed the Fire Protection Program, and its evaluation is documented in SER Section 3.0.3.2.5. The Fire Protection Program detection of aging effects stated that the program inspections are performed and documented on in-scope structures and structural components at least once in every five years. On the basis of its review of the applicant's program, aging effects, and plant-specific and industry operating experience, the staff found that, since these components will be visually inspected at least once every five years, the aging effect on concrete material is effectively managed using the Fire Protection Program.

During its review, the staff noted that line items 221 and 222 of LRA Table 3.5.2-36, elastomer material, and below grade environment, refer to Notes J and 527. For these two line items, no aging effect is identified and no AMP is applied by the applicant. Note J states "Neither the component nor the material and environment combination is evaluated in NUREG-1801", and Note 527 states "These below-grade elastomer components are sheltered from air, elevated temperature, and ultraviolet and ionizing radiation. They do not have aging effects requiring management." RAI 3.5.2.3-4, dated May 8, 2008, was issued to ask the applicant to provide the technical basis of not having aging effects requiring management for elastomer material in below grade environment.

In a letter dated June 16, 2008, the applicant stated: "Cracking and change in material properties due to thermal exposure are not aging effects requiring management for elastomers below grade since the elastomers are sheltered by either concrete or structural backfill, and, therefore, are not exposed to temperatures greater than 95ºF. Below grade waterstops are installed between wall and foundation mat junctions, waterproofing membranes are installed below grade to exterior horizontal and vertical surfaces of structures, and below grade piping expansion bellows (associated with Unit 1) are used to accommodate differential movement between the Reactor Containment Building and piping. Temperatures at installed locations for these elastomers are mild and are below the threshold where elastomer degradation can occur. Components below grade are not exposed to ionizing radiation above the threshold (1 E+6 rads) for aging effects to be applicable. Components below grade are also shielded from exposure to ultraviolet radiation and ozone that could cause degradation of rubber. Therefore, there are no aging effects requiring management for these elastomer structural components in a below grade environment."

On the basis of its review of the applicant's response to RAI 3.5.2.3-4, the staff finds that no aging effect requires management for elastomers below grade to be acceptable because the below grade elastomers are not exposed to temperatures greater than 95oF, ionizing radiation above 1E+6 rads, or ultraviolet radiation and ozone which could cause degradation of elastomers. Therefore, the staff's concern described in RAI 3.5.2.3-4 is resolved

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations for Containments, Structures, and Component Supports - Summary of Aging Management Evaluation – Bulk Structural Commodities not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the containments, structures and component supports components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6 Aging Management of Electrical and Instrumentation and Controls System

The following information documents the staff's review of the applicant's AMR results for the electrical and instrumentation and controls (I&C) components and component groups of:

- Cable connections (metallic parts)
- Electrical cables and connections
- Fuse holders - insulation material
- High-voltage insulators
- Metal enclosed bus (Unit 2 only)
- Switchyard bus and connections (Unit 1 only)
- Transmission conductors and connections

3.6.1 Summary of Technical Information in the Application

LRA Section 3.6 provides AMR results for the electrical and I&C components and component groups. LRA Table 3.6.1, "Summary of Aging Management Evaluations in Chapter VI of NUREG-1801 for Electrical Components," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the electrical and I&C components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.6.2 Staff Evaluation

The staff reviewed LRA Section 3.6 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the electrical and I&C components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted a review of 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 evaluation are documented in SER Section 3.6.2.1.

In the review, the staff also 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 3.6.2.2 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 that were 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.

For systems and components (SCs) which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

Table 3.6-1 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 Instrumentation and Controls in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements (3.6.1-1)	Degradation due to various aging mechanisms	Environmental Qualification of Electric Components	Yes	Environmental Qualification (EQ) of Electrical Components (B.2.14)	Consistent with GALL, (See Section 3.6.2.2.1)

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
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 Environmental Qualification Requirements (B.2.11)	Consistent with GALL (See Section 3.6.2.1)
Conductor insulation for electrical cables and connections used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (3.6.1-3)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables And Connections Used In Instrumentation Circuits Not Subject to 10 CFR 50.49 EQ Requirements	No	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits (B.2.12)	Consistent with GALL (See Section 3.6.2.1)
Conductor insulation for inaccessible medium voltage (2 kV to 35 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements (3.6.1-4)	Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion, water trees	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements	No	Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (B.2.21)	Consistent with GALL (See Section 3.6.2.1)
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 (B.2.7)	Consistent with GALL (See Section 3.6.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	Further Evaluation in GALL Report	AMP in LRA, Supplements, or Amendments	Staff Evaluation
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 BVPS (See Section 3.6.2.1.1)
Metal enclosed bus - bus, connections (3.6.1-7)	Loosening of bolted connections due to thermal cycling and ohmic heating	Metal Enclosed Bus	No	Metal Enclosed Bus (Unit 2 only) (B.2.26)	Consistent with GALL (See Section 3.6.2.1)
Metal enclosed bus - insulation, insulators (3.6.1-8)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Metal Enclosed Bus	No	Metal Enclosed Bus (Unit 2 only) (B.2.26)	Consistent with GALL (See Section 3.6.2.1)
Metal enclosed bus - enclosure assemblies (3.6.1-9)	Loss of material due to general corrosion	Structures Monitoring Program	No	Structures Monitoring Program (B.2.39)	Consistent with GALL (See Section 3.6.2.1)
Metal enclosed bus - enclosure assemblies (3.6.1-10)	Hardening and loss of strength due to elastomers degradation	Structures Monitoring Program	No	Not applicable	Not applicable to BVPS (See Section 3.6.2.3)

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
High-voltage insulators (3.6.1-11)	Degradation of insulation quality due to presence of any salt deposits and surface contamination; loss of material caused by mechanical wear due to wind blowing on transmission conductors	A plant-specific aging management program is to be evaluated	Yes	None	Consistent with GALL Report (See SER Section 3.6.2.2)
Transmission conductors and connections; switchyard bus and connections (3.6.1-12)	Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; increased resistance of connection due to oxidation or loss of preload	A plant-specific aging management program is to be evaluated	Yes	None	Consistent with GALL Report (See SER Section 3.6.2.2)
Cable Connections - metallic parts (3.6.1-13)	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection	No	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (B.2.10)	Consistent with GALL (See Section 3.6.2.1)
Fuse Holders (Not Part of a Larger Assembly) - insulation material (3.6.1-14)	None	None	No	Not applicable	Consistent with GALL (See Section 3.6.2.1)

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, AERMs, and the following programs that manage aging effects for the electrical and I&C components:

- Boric Acid Corrosion
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits
- Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection
- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Metal Enclosed Bus (Unit 2 only)
- Structures Monitoring

LRA Table 3.6.2-1 summarizes AMRs for the electrical and instrumentation and controls components and indicates AMRs claimed to be consistent with the GALL Report.

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

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

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff reviewed these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff reviewed these line items to verify consistency with the GALL

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

Note C indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the 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 line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

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

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

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the electrical and I&C components that are subject to an AMR. On the basis of its review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.6.1, the applicant's references to the GALL Report are acceptable and no further staff review is required.

3.6.2.1.1 AMR Results Identified as Not Applicable

The staff reviewed LRA Table 3.6.1, which summarizes the results of AMR evaluations in Chapter VI of the GALL Report for the electrical and instrumentation and controls component groups.

In LRA Table 3.6.1 Item 3.6.1-6 discussion column, the applicant stated that fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation of fuse holders (not part of a larger assembly) metallic clamp is not applicable to BVPS because all fuse holders utilizing metallic clamps are either part of an active device or located in circuits that perform no license renewal intended function. In accordance with 10 CFR 54.21(a)(1)(i), fuse holders installed in an active assembly are a piece part of an active assembly and are not required to be subject to an AMR. Therefore, the staff finds that fuse holders with metallic clamps at BVPS are not subject to an AMR.

The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing 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 with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.6.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the electrical and I&C components and provides 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, loss of material due to mechanical wear
- Loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.6.2.2. The staff's review of the applicant's further evaluation follows.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

LRA Section 3.6.2.2.1 states that EQ is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.4 documents the staff's review of the applicant's evaluation of this TLAA.

3.6.2.2.2 Degradation of Insulator Quality Due to Salt Deposits or Surface Contamination, Loss of Material Due to Mechanical Wear

The staff reviewed LRA Section 3.6.2.2.2 against the criteria in SRP-LR Section 3.6.2.2.2. SRP-LR Section 3.6.2.2.2 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.

LRA Section 3.6.2.2.2 stated that various airborne materials such as dust, salt and industrial effluent can contaminate insulator surface. The buildup of surface contamination is gradual and in most areas washed away by rain. The glazed insulator surface aids this contamination removal. However, a large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the sea coast where salt spray is prevalent. The applicant further stated that BVPS is not located near seacoast where salt spray is prevalent. However, it is located west of a fossil generation plant and the fossil plant is a modern plant that does not emit soot and the fossil plant existed prior to the completion of the BVPS facility. The applicant also stated that this area normally receives more than moderate rainfall, and any gradual buildup is washed away by rain. Although abnormal weather conditions may affect insulators, the applicant stated that these are event-driven effects, not age-related effects.

The applicant also stated that mechanical wear could be an aging effect for strain and suspension insulators in that they are subject to movement. Movement of the insulators can be caused by wind blowing the supported transmission conductor, causing it to swing from side to side. If this swinging is frequent enough, it could cause wear in the metal contact points of the insulator string and between an insulator and supporting hardware. Although this mechanism is possible, experience has shown that the transmission conductors do not normally swing and that when they do, due to a substantial wind, do not continue to swing for very long once the wind has subsided. The applicant further stated that wear has not been apparent during routine inspection of BVPS insulators.

Staff Evaluation. The staff noted that for a plant which is located near a fossil generation plant, surface contamination of high-voltage insulators may be a problem in these industrial areas where there is greater concentration of airborne particles. In a letter dated May 15, 2008, the staff issued RAI 3.6-3 requesting that the applicant explain why surface contamination of high-voltage insulators due to soot emitted from fossil plants is not a concern at Beaver Valley. The staff also requested the applicant to describe operating experience with weather events that affect high-voltage insulators and explain why these events are not aging effects requiring management for high-voltage insulators.

In its response dated June 17, 2008, the applicant stated that BVPS is located west of a fossil generation plant. LRA Appendix E, Section 2.4 states that the prevailing winds are from the west. The prevailing wind blows industrial effluents from the fossil plant away from BVPS and the switchyard. This area normally receives more than moderate rain fall. LRA Appendix E, Section 2.4, states that this area experiences more frequent precipitation than found elsewhere in the state. The frequent moderate rainfall washes away surface contamination. The applicant further stated that it performed specific operating experience searches for high-voltage insulator contamination and there were no instances of degradation of high-voltage insulators identified for BVPS. The staff found the applicant response acceptable. The staff noted that prevailing winds are from the west and blow industrial effluents from the fossil plant away from the BVPS. In addition, frequent rainfall washes away surface contamination. Furthermore, the applicant has confirmed that no operating experience of degradation of high-voltage insulators has been identified for BVPS. Based on this information, the staff determined that surface contamination of high-voltage insulators due to soot emitted from fossil plants is not a concern at BVPS.

The staff noted that although loss of material of insulators due to mechanical wear is possible, experience has shown that the transmission conductors do not normally swing significantly. When they do swing due to a substantial wind, they do not continue to swing for very long time after the wind has subsided. Wind loading that can cause a transmission line and insulators to sway is considered in the design and installation. The staff also noted that the applicant's routine maintenance inspections have not identified any loss of material of insulators due to mechanical wear. In addition, the transmission conductors within the scope of license renewal are typically in short spans and the surface areas exposed to wind loads are not significant. Therefore, the staff determined that loss of material due to wear is not considered an aging effect and which would cause a loss of intended functions of the insulator at BVPS.

Based on the technical justification identified above, the staff concludes that the applicant meets SRP-LR Section 3.6.2.2.2 criteria. For those line items that apply to LRA Section 3.6.2.2.2, the staff determines that the applicant has adequately addressed the potential aging degradation of high-voltage insulator.

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

The staff reviewed LRA Section 3.6.2.2.3 against the criteria in SRP-LR Section 3.6.2.2.3. SRP-LR Section 3.6.2.2.3 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 may occur in transmission conductors and connections and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

LRA Section 3.6.2.2.3 states that overhead transmission conductors are subject to aging management review if they are necessary for recovery of offsite power following an SBO. At BVPS, overhead transmission conductors located between the switchyard breakers and the system station service transformers support recovery of offsite power following a SBO. Other transmission conductors are not subject to an AMR since they do not perform a license renewal intended function. The applicant also states that wind loading can cause overhead transmission conductor vibration, or sway. Consideration is given to wind loading during the design and installation phase. Loss of material that could be caused by overhead transmission conductor vibration or sway is not a significant aging effect in that it would not cause a loss of intended function.

The applicant also states that the most prevalent mechanism contributing to loss of conductor strength of an aluminum conductor steel reinforced (ACSR) transmission conductor is corrosion, which includes corrosion of the steel core and aluminum strand pitting. Corrosion in ACSR conductors is a very slow-acting mechanism and the corrosion rates depend largely on air quality, which includes suspended particles chemistry, sulfur dioxide concentration in air, precipitation, fog chemistry and meteorological conditions. In addition, the applicant states that air quality in rural areas typically contains low concentration of suspended particles and sulfur dioxide, which keeps the corrosion rate to a minimum. A fossil plant is located east of BVPS, the prevailing winds are from the west, and there are no other industries in the immediate rural area. The applicant further states that the BVPS overhead transmission conductors subject to aging management review were bounded by Ontario Hydro test population. The applicant further states that the BVPS overhead transmission conductors have an ultimate strength margin greater than the Ontario Hydro test cables after 80 years of service. The installation configuration at BVPS is representative of the tested samples, so the conclusions in the Ontario Hydro Study are valid for BVPS, per the applicant.

The applicant states that the design of the transmission conductor bolted connections precludes torque relaxation, and the BVPS plant-specific operating experience support this statement, since plant operating experience has not identified failures of switchyard connections due to aging. The applicant further states that the typical design of switchyard bolted connection includes Belleville washers and is coated with an anti-oxidant compound (a grease-type sealant) prior to tightening the connection to prevent the formation of oxides on the metal surface and to prevent moisture from entering the connection thus reducing the chances of corrosion. In addition, the applicant states that BVPS design incorporates the use of Belleville washers on bolted electrical connections of dissimilar metals to compensate for temperature changes to maintain the proper torque and prevent loosening.

The applicant states that the switchyard bus subject to aging management review is constructed of rigid aluminum pipe. The switchyard bus is connected to short lengths of flexible conductors to minimize vibration from support and active components such as circuit breakers. Based on this design configuration, wind induced vibration is not a significant aging mechanism. The bolted connections associated with the switchyard bus are for the connection to station post-insulators used to support the bus. All other connections to the bus are welded. The components involved in switchyard bus connections are constructed of aluminum, galvanized steel and stainless steel. No organic materials are involved. In addition, the applicant states that with no rigid connection to moving or vibrating equipment, loss of material due to vibration is not a significant aging effect requiring management. Aluminum bus exposed to the service conditions of the BVPS 138 kV switchyard does not experience any appreciable aging effects, except for minor oxidation, which does not impact the ability of the switchyard bus to perform its intended function. The applicant also states that connection surface oxidation and loosening of bolted connection for aluminum switchyard bus are not applicable since the switchyard bus connections requiring aging management review are welded connections. However, the flexible conductors, which are welded to switchyard bus, are bolted to the other switchyard components. These switchyard components connections are also included in the routine maintenance of the 138 kV switchyard, the applicant states that this maintenance verifies the effectiveness of the connection design and installation practices.

Staff Evaluation. The staff reviewed LRA Section 3.6.2.2.3 and based on the review, the staff noted that the wind loading that can cause a transmission line and insulators to vibrate is considered in the design and installation. Experience shows that the transmission conductors do not normally swing significantly. When they do swing due to a substantial wind, they do not continue to swing for a very long time after the wind has subsided. In addition, the applicant has confirmed that no plant-specific operating experience related to loss of material of transmission due to vibration or sway has been identified. Therefore, the staff found that loss of material caused by transmission conductor sway is not an applicable aging effect requiring management at BVPS and it will not cause a loss of intended function of the conductors.

The applicant stated that the BVPS overhead transmission conductors subject to aging management review were bounded by Ontario Hydro test population. The BVPS overhead transmission conductors have an ultimate strength margin greater than the Ontario Hydro test cables after 80 years of service. The applicant also states that the installation configuration at BVPS is representative of the tested samples, so the conclusions in the Ontario Hydro Study are valid for BVPS. However, the applicant did not provide information to substantiate the conclusion that the Ontario Hydro Study bounds the transmission conductors at BVPS. In a letter dated May 15, 2008, the staff issued RAI 3.6-4, requesting the applicant to explain in detail how transmission conductors installed at BVPS were bounded by the Ontario Hydro test and will have adequate margin for 60 years.

In its response dated June 17, 2008, the applicant stated that a 4/0 aluminum conductor steel reinforced (ACSR) 212 million circular mills (MCM) with 6/1 stranding (6 aluminum strands, and 1 galvanized steel strand) transmission conductor type has the lowest initial design margin in the National Electrical Safety Code (NESC). Also, the 6/1 stranding is the most susceptible to corrosion. The applicant provided the following illustration using the 4/0 ACSR transmission conductor to provide reasonable assurance that the BVPS transmission conductors will have ample strength through the period of extended operation:

The NESC requires that tension on installed conductors be a maximum of 60% of the ultimate conductor strength. The NESC also sets the maximum tension a conductor must be designed to withstand under heavy load requirements, which includes consideration of ice, wind and temperature. These requirements are viewed concerning the specific conductors included in the AMR. The conductor size with the smallest ultimate strength margin (4/0 ACSR) is used as an illustration. The applicant stated that the ultimate strength and the NESC heavy load tension requirements of 4/0 ACSR are 8350 lbs. and 2761 lbs., respectively. The margin between NESC heavy load and the ultimate strength is 5589 lbs., which is 67% of ultimate strength margin. The Ontario Hydroelectric Test showed a 30% loss of composite conductor strength in an 80 years old conductor. In the case of the 4/0 ACSR transmission conductors, a 30% loss of ultimate strength would mean that there would still be adequate margin between the design maximum established by the NESC and the actual conductor strength. The applicant further stated that the BVPS transmission conductors within scope for license renewal are ACSR 795 MCM with a 26/7 stranding. The Ontario Hydro test population included smaller ACSR conductors with the same stranding configuration as the BVPS conductors. The BVPS transmission conductors have an ultimate strength of 31,656 lbs., the installed maximum NESC heavy loading span is 10,000 lbs., the installed maximum bare loading is 4,561 lbs., and the maximum final tension allowed by NESC is 18,993 lbs., which bounds the installed tension. The margin between the NESC heavy load and the ultimate strength is 21,656 lbs, which is a 68.4% ultimate strength margin. The Ontario Test demonstrated a 30% loss of ultimate strength in an 80-year-old conductor. This demonstrates that the BVPS conductors will have greater than 38% ultimate strength margin remaining after 80 years.

The staff found the applicant's response acceptable because of the following: the staff noted that the margin between the NESC heavy load tension requirements and the ultimate strength for transmission conductors at BVPS is 68.4% ultimate strength margin and 30% loss of ultimate strength still give the BVPS conductor greater than 38% ultimate strength margin remaining after 80 years of service life which is more conservative than the 60-year service life. This shows that the BVPS transmission conductors will have ample strength through the period of extended operation. Therefore, the staff concluded that loss of conductor strength due to corrosion of the transmission conductors is not a significant aging effect requiring management for the period of extended operation at BVPS.

The staff noted that in EPRI document TR-104213, "Bolted Joint Maintenance & Application Guide," it identified a special problem with Belleville washers. Hydrogen embrittlement is a recurring problem with Belleville washers and other springs. When springs are electroplated, the plating process forces hydrogen into the metal grain boundaries. If the hydrogen is not removed, the spring may spontaneously fail at any time while in service. In RAI 3.6-5, dated May 15, 2008, the staff requested that the applicant describe the types of finishes the Belleville washers currently have and current activities used to confirm the effectiveness of switchyard bolted connections.

In its response dated June 17, 2008, the applicant stated that since the Belleville washers used in the in-scope transmission conductor and switchyard bus connections are stainless steel, the issue of entrapment of hydrogen in a washer by poor electroplating practices is not applicable to BVPS. The applicant further stated that the switchyard component connections are included in the routine maintenance of the 138 kV switchyard which verifies the effectiveness of the connection design and installations. In addition, the applicant performs infrared inspection of the 138 kV switchyard connections during repetitive maintenance tasks. These routine tasks verify the condition of the switchyard connection for BVPS. BVPS uses industry guidance to govern its infrared thermography program. The staff found the applicant response acceptable. Hydrogen embrittlement is not a potential problem with Belleville washers for BVPS because the Belleville washers used in the in-scope transmission conductors and switchyard bus connections are stainless steel. To confirm the effectiveness of switchyard bolted connections, the applicant performs periodic infrared inspection on switchyard bolted connections.

The staff noted that connections to the switchyard bus are welded. However, the conductor connections are generally of the bolted category. Components in the switchyard are exposed to precipitation. Connection materials exposed to the service conditions of the switchyard do not experience any appreciable aging effects except minor oxidation of the exterior surfaces, which does not impact the ability of the switchyard bus to perform its intended function. The staff also noted that pre-load of bolted switchyard bus connections is maintained by the appropriate design and the use of lock and Belleville washers that absorb vibration and prevent loss of pre-load. Using an anti-oxidant compound (a grease-type sealant) prior to tightening the connection prevents the formation of oxides on the metal surface and to prevent moisture from entering the connection, thus reducing the chances of corrosion. The applicant stated that that based on operating experience, this method of installation has been shown to provide a corrosion resistance and low electrical resistance connection. The applicant also stated that the connections at switchyard are periodically evaluated via thermography as preventive maintenance. The staff concluded that increased resistance of connections due to oxidation or loss of pre-load has been adequately addressed because the design which uses lock and

Belleville washers is in accordance with EPRI-104213 recommendations, periodic thermography of conductor and bus bolted connections, and no adverse operating experience conditions existing at BVPS.

Based on the program identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.6.2.2.3. For those line items that apply to LRA Section 3.6.2.2.3, the staff determined that the applicant has addressed loss of material, loss of conductor strength, and increased resistance connections or loss of preload.

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 through J, which the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

Staff Evaluation. In LRA, Table 3.6.1, under Item Number 3.6.1-10, Metal enclosed bus – Enclosure assemblies," states that an AMR is not required for enclosure gaskets because they are consumables. Consumables are considered short-lived or periodically replaced. In a letter to NEI dated March 10, 2000, "License Renewal Issue No. 98-12, "CONSUMABLES," the staff indicated to the industry that packing, gaskets, component seals, and O-rings are structures, components, or commodity groups, that met 10 CFR 54.21(a)(1)(i), are required an AMR. Since enclosure gaskets are not periodically replaced, they are not qualified as consumable items. In a letter dated May 15, 2008 the staff issued RAI 3.6-2 requesting that the applicant provide an AMR for enclosure gaskets or provide a technical justification of why these components are excluded from an AMR.

In its response dated June 17, 2008, the applicant stated that the in-scope 480 V metal enclosed-bus does not contain elastomers except for the gaskets that provide a seal around the edge of the access covers. The access cover gasket is not subject to an AMR since it is replaced when the cover is removed; aging management is not required for items replaced based on a specified time period per 10 CFR 54.21(a)(1)(ii). In addition, the applicant stated that during the period of extended operation, the access cover gasket will be replaced in conjunction with preventive maintenance inspections. Since the access cover gasket is replaced periodically, it was considered a consumable for the AMR process. To clarify the applicant position that metal-enclosed bus access cover elastomer gaskets are consumable, the applicant revises LRA Appendix B, Section B.2.26, program description to include the following text in an enclosure for the revision to the LRA:

> In-scope metal enclosed bus enclosures have removable covers that allow access for inspection and maintenance. These removable covers have gaskets that provide a seal around the edge of the covers. The gasket is a consumable and is replaced during the visual inspection of bus internal surface.

The staff found the applicant response acceptable because the in-scope 480 V metal-enclosed bus does not contain elastomers except for the gaskets that provide a seal around the edge of the access covers. During the period of extended operation, the access cover gasket will be replaced periodically in conjunction with preventive maintenance inspections. Since the access cover gasket is replaced based on a specified time period, it is not subject to aging management review per 10 CFR 54.21(a)(1)(ii).

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

In some plants, tie wraps may be taken credit for in seismic analysis and in plant design specifications primary for separation to preclude ampacity degrading. Industrial operating experience has identified issues with tie wraps. Tie wraps were brittle, degraded, or missing and tie wraps failures affected safety functions of other system/components. In the LRA, the applicant does not discuss tie wraps as a commodity type requiring aging management reviews (AMRs). In a letter dated May 15, 2008, the staff issued RAI 3.6-6 requesting that the applicant explain why tie wraps are not included in the AMRs.

In response dated June 17, 2008, the applicant stated that at BVPS, electrical cable ties do not function as cable supports in raceway support analysis, therefore, the installation and inspection criteria is limited to the application of standard practices in providing quality cable bundles and cable replacement. Seismic qualification of cable trays does not credit the used of electrical ties. In addition, the applicant stated that it performed a review of BVPS documents (e.g., procedure, UFSAR, electrical design basis document, and specifications) to identify criteria for electrical cable tie use for BVPS. Based on the documents, electrical cable ties serve to retain cables during installation, providing a neat and orderly installation. The BVPS scoping review identified electrical ties as an installation aid for electrical cable. Once the installation of cable is complete, the weight of cable will maintain cable placement. Since electrical cable ties are not credited for cable placement or support, the failure of electrical cable ties will not affect the design analysis/calculation for the ampacity of cable trays. In addition the applicant stated that it reviewed site operating experience to confirm that BVPS has had no equipment failures due to electrical cable ties. Electrical cable ties do not perform a license renewal intended function per 10 CFR 54.4.

The staff found the applicant response acceptable. Tie wraps are not credited for in seismic analysis or design analysis in the current license basis and failures of tie wraps will not affect components to perform their intended function(s) during license renewal. Therefore, the staff found that tie wraps are not in-scope of license renewal.

3.6.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the electrical and I&C components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.7 Conclusion for Aging Management Review Results

The staff reviewed the information in LRA Section 3, “Aging Management Review Results,” and LRA Appendix B, “Aging Management Programs and Activities.” On the basis of its review of the AMR results and AMPs, the staff concludes, pending resolution of Open Item 3.0.3.1.11-1**,** that the applicant has demonstrated that the aging effects will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable UFSAR supplement program summaries and concludes that the supplement adequately describes the AMPs credited for managing aging, as required by 10 CFR 54.21(d).

With regard to these matters, the staff concludes that there is reasonable assurance that the applicant will continue to conduct the activities authorized by the renewed licenses will continue to be conducted in accordance with the CLB, and any changes made to the CLB, in order to comply with 10 CFR 54.21(a)(3), are in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 4

TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses

This Section of the safety evaluation report (SER) addresses the identification of time-limited aging analyses (TLAAs). In license renewal application (LRA) Sections 4.2 through 4.7, FirstEnergy Nuclear Operating Company (FENOC or the applicant) addressed the TLAAs for Beaver Valley Power Station Units 1 and 2. SER Sections 4.2 through 4.8 documents the review of the TLAAs conducted by the staff of the United States (US) Nuclear Regulatory Commission (NRC) (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.

In addition, pursuant to 10 CFR 54.21(c)(2), applicants must list plant-specific exemptions granted under 10 CFR 50.12 based on TLAAs. For any such exemptions, the applicant must evaluate and justify the continuation of the exemptions for the period of extended operation.

Unit 1 and Unit 2 are constructed of similar materials with similar environments. Therefore, the mechanical system and component information presented in the LRA typically applies to both units, and no unit-specific identifier is listed. However, design differences exist between Unit 1 and Unit 2. Those design differences are identified by using a designator (*i.e.*, Unit 1 only or Unit 2 only). Further, the applicant assigned a different designator (*i.e.*, common) for those cases where the system, structure, or component is used and/or shared by both units.

4.1.1 Summary of Technical Information in the Application

To identify the TLAAs, the applicant evaluated calculations for BVPS against the six criteria specified in 10 CFR 54.3. The applicant indicated that it identified the calculations that met the six criteria by searching the current licensing basis (CLB). The CLB includes the updated final safety analysis report (UFSAR), engineering calculations, technical reports, engineering work requests, licensing correspondence, and applicable vendor reports. In LRA Table 4.1-1, "List of BVPS Time-Limited Aging Analyses and Resolution," the applicant listed the applicable TLAAs:

- reactor vessel neutron embrittlement
- metal fatigue
- environmental qualification (EQ) of electric equipment
- concrete containment tendon prestress
- containment liner plate, metal containment, and penetrations fatigue
- piping subsurface indications (Unit 1 only)
- reactor vessel underclad cracking (Unit 1 only)
- main coolant loop piping leak-before-break
- pressurizer surge line piping leak-before-break
- branch line piping leak-before-break (Unit 2 only)

- high-energy line break postulation
- settlement of structures (Unit 2 only)
- crane load cycles

Pursuant to 10 CFR 54.21(c)(2), the applicant stated that it did not identify exemptions granted under 10 CFR 50.12 based on a TLAA as defined in 10 CFR 54.3.

4.1.2 Staff Evaluation

In LRA Section 4.1, the applicant listed the Unit 1 and Unit 2 TLAAs. The staff reviewed the information to determine whether the applicant has provided sufficient information pursuant to 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2).

As defined in 10 CFR 54.3, TLAAs meet the following six criteria:

(1) involve systems, structures, and components within the scope of license renewal, as described in 10 CFR 54.4(a)

(2) consider the effects of aging

(3) involve time-limited assumptions defined by the current operating term (40 years)

(4) are determined to be relevant by the applicant in making a safety determination

(5) involve conclusions, or provide the basis for conclusions, related to the capability of the system, structure, and component to perform its intended functions, as described in 10 CFR 54.4(b)

(6) are contained or incorporated by reference in the CLB

The applicant reviewed the list of common TLAAs in NUREG-1800, Revision 1, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants” (SRP-LR), dated September 2005. The applicant listed TLAAs applicable to BVPS in LRA Table 4.1-1.

As required by 10 CFR 54.21(c)(2), the applicant must list all exemptions granted under 10 CFR 50.12, based on TLAAs, and evaluated and justified for continuation through the period of extended operation. The LRA states that each active exemption was reviewed to determine whether it was based on a TLAA. The applicant did not identify any TLAA-based exemptions. 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 the period of extended operation.

4.1.3 Conclusion

Based on its review, the staff concludes that the applicant has provided an acceptable list of TLAAs, as required by 10 CFR 54.21(c)(1). The staff confirms, as required by 10 CFR 54.21(c)(2), that no exemption pursuant to 10 CFR 50.12 has been granted based on a TLAA.

4.2 Reactor Vessel Neutron Embrittlement

"Neutron embrittlement" describes changes in the mechanical properties of reactor vessel (RV) materials (or any other ferrous materials) resulting from exposure to fast neutron (E>1.0 MeV) fluence. The rate of neutron exposure is defined as neutron flux, and the cumulative degree of exposure over time is defined as neutron fluence. Fracture toughness of ferritic materials not only depends on fluence but, also on temperature. The area within the vicinity of the reactor core called the beltline region is defined by 10 CFR 50.61 as:

> The region of the reactor vessel (shell material including welds, heat-affected zones and plates and forgings) that directly surrounds the effective height of the active core and adjacent regions of the reactor vessel that are predicted to experience sufficient neutron radiation damage to be considered in the selection of the most limiting material with regard to radiation damage.

The most pronounced material change (and most relevant in this review) is reduction in fracture toughness. Neutron fluence reduces fracture toughness, which is the material's resistance to crack propagation. The reference temperature for nil-ductility transition (RT_{NDT}) is a metric of the temperature above which the material becomes ductile and below which it becomes brittle. RT_{NDT} increases with fluence, meaning higher temperatures are required for the material to remain ductile. In pressure vessel applications, the RT_{NDT} is increased by a margin term added to account for uncertainties from the available limited materials data.

In addition to the beltline region, materials in the extended beltline region above or below the beltline that exceed fluence values of 1.0E+17 n/cm^2 (E>1.0 MeV) are subject to the requirements of 10 CFR 50 Appendix H and must be monitored for evaluation of changes in fracture toughness at end-of-license-extended.

Determination of the reduction in fracture toughness, affects several RV analyses that support plant operation, including:

- Neutron Fluence Values;
- Pressurized Thermal Shock (PTS);
- Charpy V notch Upper-Shelf Energy CvUSE); and
- Pressure-Temperature (P-T) Limits

These analyses of the reduction of fracture toughness of the RVs for 40 calendar years are TLAAs and must be evaluated for the period of extended operation.

4.2.1 Neutron Fluence Values

4.2.1.1 Summary of Technical Information in the Application

In LRA Section 4.2.1, the applicant summarized its evaluation of neutron fluence values for the period of extended operation as follows:

> The loss of fracture toughness is an aging effect caused by the neutron embrittlement aging mechanism resulting from prolonged exposure to neutron radiation. This process increases tensile strength and hardness of the material

and reduces toughness. The rate of neutron exposure is defined as neuron flux and the cumulative degree of exposure over time is called neutron fluence. As neutron embrittlement progresses, the toughness/temperature curve shifts downward (lower fracture toughness) and to the right (brittle/ductile transition as temperature increases).

4.2.1.1.1 Unit 1

In the spring of 2000, Surveillance Capsule Y was pulled for analysis and was documented in Westinghouse Commercial Atomic Power (WCAP)-15571, "Analysis of Capsule Y from First Energy Company Beaver Valley Unit 1 Reactor Vessel Radiation Surveillance Program." For license renewal, WCAP-15571, Supplement 1, "Analysis of Capsule Y from First Energy Company Beaver Valley Unit 1 Reactor Vessel Radiation Surveillance Program," documents the end-of-license-extended analysis for neutron fluence values.

LRA Tables 4.2-1 and 4.2-2 show the calculated fast neutron fluence (E> 1.0 MeV) values at the inner surface of the Unit 1 RV for the beltline and extended beltline materials, respectively. These values, projected by Evaluated Nuclear Data File/B-VI cross sections, are based on the results of the Capsule Y analysis and comply with Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence."

These fluence data tabulations include fuel cycle-specific calculated neutron exposures at the end of Cycle 17 (February 2006) as well as future projections to the end of Cycle 18 and for several intervals extending to 54 effective full-power years (EFPYs). The calculations account for a core power uprate from 2689 megawatts-thermal (MWt) to 2900 MWt at the onset of Cycle 18. Neutron exposure projections beyond the end of Cycle 17 are based on the spatial power distributions and Cycle 18 plant characteristics at the uprated power level.

4.2.1.1.2 Unit 2

In the spring of 2005, Surveillance Capsule X was pulled for analysis and was documented in WCAP-16527-NP, "Analysis of Capsule X from First Energy Nuclear Operating Company Beaver Valley Unit 2 Reactor Vessel Radiation Surveillance Program." For license renewal, WCAP-16527-NP, Supplement 1, "Analysis of Capsule X from First Energy Company Beaver Valley Unit 2 Reactor Vessel Radiation Surveillance Program," documents the end-of-license-extended analysis for neutron fluence values.

LRA Tables 4.2-3 and 4.2-4 show the calculated fast neutron fluence (E> 1.0 MeV), values at the inner surface of the Unit 2 RV for the beltline and extended beltline materials, respectively. These values, projected by Evaluated Nuclear Data File/B-VI cross sections and based on the results of the Capsule X analysis, comply with RG 1.190.

These fluence data tabulations include fuel cycle-specific calculated neutron exposures at the end of Cycle 11 (April 2005) as well as future projections for several intervals extending to 54 EFPYs based on assumptions that the core power distributions and plant operating characteristics for Cycle 12 represent plant operation to 17 EFPYs and that the preliminary Cycle 13 core power distributions apply beyond 17 EFPYs. The calculations account for a core power uprate from 2689 to 2900 MWt at 17 EFPYs.

4.2.1.2 Staff Evaluation

The staff reviewed LRA Section 4.2.1, pursuant to 10 CFR 54.21(c)(1)(i)(ii) or (iii).

4.2.1.2.1 Unit 1

The applicant submitted an updated Surveillance Capsule Y analysis report in WCAP-15571-NP, Supplement 1. Capsule Y was removed in the spring of 2000 and Supplement 1 was prepared for license renewal.

In the LRA, the applicant stated that the methodology used for the calculation of the applicable fluence values adheres to the guidance in RG 1.190 therefore, it is acceptable. The applicant further stated that it had investigated the materials which extend above and below the beltline region where fluence values were above $1x10^{17}$ n/cm^2, as specified in 10 CFR 50, Appendix H. Projected values were calculated for 54 EFPYs of operation, accounting for a very conservative 90% load factor for the entire period of operation. This calculation accounted for a power uprate from 2689 MWt to 2900 MWt. To estimate the neutron source, the applicant assumed that the current cycle (Cycle 18) loading will be the average cycle loading to the end of the extended license.

For Unit 1, the critical element regarding the reference temperature for pressurized thermal shock (RT_{PTS}) is the lower shell plate B6903-1. The peak inside surface fluence value for 54 EFPYs is $6.09x10^{19}$ n/cm^2. However, at 54 EFPYs, the RT_{PTS} value is 275.7 ˚F, which exceeds the screening criterion of 270 ˚F pursuant to 10 CFR 50.61. The applicant estimated (and the staff verified) that the RT_{PTS} screening criterion will be reached at $4.96x10^{19}$ n/cm^2 or, 43.87 EFPYs. Therefore, the validity of RT_{PTS}, P-T limit curves and LTOP limits (and the associated technical specification (TS) limits) will be valid to 43.87 EFPYs. The staff determined that additional information was required to complete its review. In a request for additional information (RAI) 4.2.4-1, dated April 28, 2008, the staff requested that the applicant provide additional details or documentation to show whether or not the low-temperature overpressure protection system was affected by the extended power uprate.

In its response to RAI 4.2.4-1, dated May 28, 2008, the applicant stated that LTOP set-points were calculated in WCAP-16799-NP and that the analyses include the power uprate to 2900 MWt.

Based on its review, the staff finds the applicant's response to RAI 4.2.4-1 for Unit 1 acceptable because the applicant's revised LTOP fluence analysis used staff approved methods and the set-points accounted for the power uprate. Therefore, the staff's concern described in RAI 4.2.4-1 for BVPS 1 is resolved.

4.2.1.2.2 Unit 2

The applicant provided Surveillance Capsule X analysis report WCAP-16527-NP, Supplement 1. Capsule X was removed in March 2005 and Supplement 1 was prepared for the license extension application.

In the LRA, that applicant stated that the methodology it had used adheres to the guidance in RG 1.190, therefore, it is acceptable. The materials investigated extended above and below the beltline region where fluence values were above $1x10^{17}$ n/cm^2 as specified in 10 CFR 50 Appendix H. Projected values are calculated for 54 EFPYs of operation that accounts for a 90% load factor for the entire period of operation that is very conservative. The calculation accounted for power uprate from 2689 MWt to 2900 MWt. To estimate the neutron source it is assumed that the Cycle 13 loading (17 EFPYs and beyond) will be the average cycle loading to the end of the extended license.

For Unit 2, the critical element in the belt region in intermediate shell plate B9004-1 and in the extended beltline region is the upper shell plate B9003-2. The peak fluence calculated for the intermediate shell plate is $6.22x10^{19}$ n/cm^2 and for the upper shell plate is $0.492x10^{19}$ n/cm^2. The resulting RT_{PTS} values of 152.4 ˚F and 160.6 ˚F respectively, are lower than the 10 CFR 50.61 screening requirement of 270 ˚F; therefore, these values are acceptable for 54 EFPYs. The staff determined that additional information was required to complete its review.

In RAI 4.2.4-1 dated April 28, 2008, the staff requested that the applicant provide additional details or documentation to show whether or not the LTOP system was affected by the extended power uprate.

In its response to RAI 4.2.4-1, dated May 28, 2008, the applicant stated that the LTOP set-points have been calculated in WCAP-15677, reflected in the Unit 2 P-T limits report (PTLR), and is valid for 22 EFPYs.

Based on its review, the staff finds the applicant's response to RAI 4.2.4-1 for Unit 2 acceptable because the applicant's revised LTOP fluence analysis used staff approved methods and the set-points accounted for the power uprate. Therefore, the staff's concern described in RAI 4.2.4-1 for Unit 2 is resolved.

4.2.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of neutron fluence values in LRA Sections A.2.2.1 and A.3.2.1. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address neutron fluence values is adequate.

4.2.1.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated that the proposed fluence values to the end-of-license-extended are acceptable because they adhere to the guidance of RG 1.190. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.2 Pressurized Thermal Shock

4.2.2.1 Summary of Technical Information in the Application

In LRA Section 4.2.2, the applicant summarized the evaluation of PTS for the period of extended operation. For protection against PTS events for pressurized-water reactors (PWRs), 10 CFR 50.61(b)(1) requires licensees to update assessments of reference temperature projected values whenever a significant change occurs in projected values for adjusted RT_{PTS} or upon a request for a change in the expiration date for the operation of the facility. Irradiation by high-energy neutrons raises the RT_{NDT} value for the RV. Determination of the initial RT_{NDT} is through testing of unirradiated material specimens. The shift in reference temperature, ΔRT_{NDT}, is the difference in the 30 ft-lb index temperatures from the average Charpy curves measured before and after irradiation. RG 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," defines the calculation methods for ΔRT_{NDT} and end-of-license upper shelf energy (USE). Determination of RT_{PTS}, defined as the RT_{NDT} value evaluated at the end-of-license fluence for each of the vessel beltline materials, is by two methods pursuant to 10 CFR 50.61(c) and described in RG 1.99, Revision 2, as Regulatory Positions (RPs) 1 and 2. RP 1 applies for material with no credible surveillance data available; RP 2, when credible material surveillance data is available. Adjusted reference temperature (ART) calculations for both RP 1 and 2 follow the guidance in RG 1.99, Revision 2, Sections 1.1 and 2.1, respectively, using copper and nickel content of beltline materials and end-of-license best estimate fluence projections. RT_{PTS} screening criteria established pursuant to 10 CFR 50.61(b)(2) are 270 °F for plates, forgings, and axial welds and 300 °F for circumferential welds.

4.2.2.1.1 Unit 1

Actions to manage the RV fluence at the limiting location have been underway at Unit 1 since the 1990s. Starting with Cycle 11 in 1995, BVPS instituted a flux management program for the fluence effects on the RT_{PTS} value of the limiting plate (lower shell plate B6903-1).

This program added hafnium rods in the peripheral fuel bundles and continued use of the standard L4P low-leakage core loading. The applicant submitted an updated RT_{PTS} analysis demonstrating that the limiting beltline plate would meet 10 CFR 50.61 requirements at the end-of-license fluence with no further flux management initiatives.

In the SER issued October 7, 1997, addressing the PTS status for Unit 1, the staff agreed and determined that the RT_{PTS} value for the limiting beltline component (plate B6903-1) at the end of the current operating term would be 267.8 °F and that BVPS 1 met 10 CFR 50.61 requirements. The BVPS 1 operation with hafnium rods installed for three cycles (removed in fall of 2001) reduced the irradiation rate by approximately 25 percent during that time period. Using the calculated chemistry factor and fluence values of the 1997 SER, the applicant determined that BVPS 1 PTS projections would remain below PTS screening criteria through the end-of-license.

In the spring of 2000, Surveillance Capsule Y was pulled for analysis documented in WCAP-15571. For license renewal, WCAP-15571, Supplement 1, documents the end-of-license-extended analysis for PTS.

Using the prescribed PTS Rule (10 CFR 50.61) methodology, the applicant generated RT_{PTS} values for beltline and extended beltline region materials of the BVPS 1 RV for fluence values at end-of-license-extended (54 EFPYs). The data for the surveillance program plate material were not credible; therefore, the applicant used the data with a σ_{Δ} (standard deviation for ΔRT_{NDT}) margin of 17 °F. The data for the BVPS 1 surveillance program weld material were credible; therefore, the applicant used a σ_{Δ} margin of 14 °F. The surveillance capsule materials are representative of the actual vessel plates and intermediate shell longitudinal weld. Chemistry factor values for the BVPS 1 beltline region materials were based on RG 1.99, Revision 2, RPs 1.1 and 2.1, for the BVPS 1 extended beltline materials on RP 1.1.

LRA Table 4.2-5 shows the RT_{PTS} values at 54 EFPYs for the BVPS 1 beltline materials. Evaluation of extended beltline materials likely to receive fluence values greater than 1.0E+17 n/cm^2 (E>1.0 MeV) determined that none of these materials were limiting. The projected RT_{PTS} values for end-of-license-extended (54 EFPYs) meet 10 CFR 50.61 screening criteria for beltline and extended beltline materials except for lower shell plate B6903-1 (heat C6317-1). The 275.7 °F RT_{PTS} for lower shell plate B6903-1 slightly exceeds the criteria. The 270 °F screening limit for lower shell plate B6903-1 will be reached at a fluence level of 4.961E+19 n/cm^2 (E>1.0 MeV), equivalent to 43.87 EFPYs. By projection, the BVPS 1 RV will reach the PTS screening criterion of 270 °F on the limiting plate (B6903-1) in the year 2033.

Section 50.61 of Title 10 of the Code of Federal Regulations allows that:

> For each pressurized water nuclear power reactor for which the value of RTPTS for any material in the beltline is projected to exceed the PTS screening criterion using the EOL fluence, the licensee shall implement those flux reduction programs that are reasonably practicable to avoid exceeding the PTS screening criterion set forth in Paragraph (b)(2) of this section.

Therefore, a sensitivity assessment of available flux reduction measures included several fuel management scenarios (*e.g.*, low-leakage core design, low-power peripheral fuel assemblies, reinsertion of hafnium rods, and the use of part-length shielded assemblies) and several assumed capacity factors up to 98 percent.

Several flux reduction options are available to maintain the limiting plate below the PTS screening criterion to the end-of-license-extended. The Reactor Vessel Integrity Program will manage flux reduction. Documentation of a flux reduction program for BVPS 1 will be in accordance with 10 CFR 50.61.

Monitoring of the BVPS 1 RV fluence will continue under the Reactor Vessel Integrity Program to keep the projected fluence below that assumed for the relevant neutron embrittlement TLAA; therefore, management of the BVPS 1 RT_{PTS} TLAA will be adequate for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.2.2.1.2 Unit 2

In the spring of 2005, Surveillance Capsule X was pulled for analysis documented in WCAP-16527-NP. For license renewal, WCAP-16527-NP Supplement 1 documents the end-of-license-extended analysis for PTS.

Using the prescribed PTS Rule (10 CFR 50.61) methodology, the applicant generated RT_{PTS} values for beltline and extended beltline region materials of the Unit 2 RV for fluence values at end-of-license-extended (54 EFPYs). The data for the surveillance program plate material are credible; therefore, the applicant used a σ_Δ margin of 8.5 °F. The data for the Unit 2 surveillance program weld material are credible; therefore, the applicant used a σ_Δ margin of 14°F. The surveillance capsule materials are representative of the actual vessel plate and intermediate shell longitudinal weld. Chemistry factor values for the Unit 2 beltline region materials were based on RG 1.99, Revision 2, RPs 1.1 and 2.1, for the Unit 2 extended beltline materials on RP 1.1.

LRA Table 4.2-6 shows the RT_{PTS} values at 54 EFPYs for the Unit 2 beltline materials. The applicant also evaluated the extended beltline materials likely to receive fluence values greater than 1.0E+17 n/cm^2 (E>1.0 MeV). The limiting plate material is the upper shell plate (B9003- 2) with a projected end-of-license-extended RT_{PTS} value of 160.6 °F for 54 EFPYs. The limiting weld material is the upper shell longitudinal weld (heat number BOHB (E-8018)) with an end of-license-extended RT_{PTS} value of 128.8 °F. The projected RT_{PTS} values for end-of-license-extended (54 EFPYs) meet 10 CFR 50.61 screening criteria for beltline and extended beltline materials; therefore, disposition of the Unit 2 RT_{PTS} TLAA is in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.2.2 Staff Evaluation

The staff reviewed LRA Section 4.2.2 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The PTS evaluation provides a means for assessing the susceptibility of the RV beltline materials to PTS events in order to ensure that these materials have adequate fracture toughness to support reactor operation, pursuant to the methods of evaluation and safety criteria of 10 CFR 50.61. The staff's review covered the applicants PTS methodology and RT_{PTS} calculations at the end of the period of extended operation, taking into consideration the effects of neutron embrittlement. The acceptance criteria for PTS are based on (1) 10 CFR 50, Appendix A, General Design Criterion (GDC)-14, which requires that the reactor coolant pressure boundary (RCPB) be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture; (2) GDC-31, which requires that the RCPB be designed with margin sufficient to assure that, under specified conditions, it will behave in a nonbrittle manner and minimize the probability of a rapidly propagating fracture; and (3) 10 CFR 50.61, which sets fracture toughness criteria for protection against PTS events.

The requirements in 10 CFR 50.61 are established to protect PWR vessels against the consequences of PTS events. The rule requires licensees operating PWRs to calculate end-of-license RT_{PTS} values (as defined in 10 CFR 50.61) for each base metal and weld material in the RV constructed from carbon or low alloy steel materials. The rule also requires that RT_{PTS} values remain below the PTS screening criteria throughout the serviceable life of the facilities. The rule sets a maximum limit of 270 °F for RT_{PTS} values that are calculated for base metals *(i.e.,* forging and plate materials) and axial weld materials and a maximum limit of 300 °F for RT_{PTS} values that are calculated for circumferential weld materials.

Section 50.61 of 10 CFR provides requirements for calculating these RT_{PTS} values, similar to the calculation methodology described in RG 1.99, Revision 2, for determining ART values. 10 CFR 50.61 requires that these calculations account for the effects of neutron radiation and incorporate any relevant RV surveillance capsule data required for reporting as part of the licensee's implementation of its RV materials surveillance program. 10 CFR 50.61 defines RT_{PTS} as the RT_{NDT} value at the clad/base metal interface evaluated for the end-of-license fluence. Therefore, RT_{PTS} is equal to the sum of the initial RT_{NDT}, ΔRT_{NDT}, and the margin term. ΔRT_{NDT} is the product of a chemistry factor and a fluence factor. The chemistry factor is dependent upon the amount of copper and nickel in the material and may be determined using tables provided in 10 CFR 50.61 and is equivalent to the method described in RG 1.99, Revision 2, RP 1.1, for ART calculations. The chemistry factor also may be determined from credible surveillance data and is equivalent to the method described in RG 1.99, Revision 2, RP 2.1, for ART calculations. If credible surveillance data is available for the RV beltline material being analyzed, then the surveillance data must be used when it results in an RT_{PTS} value that is higher (*i.e.*, more conservative) than was calculated using the tables. Either method may be used if the credible surveillance data results in a lower RT_{PTS} value. The fluence factor is dependent upon the neutron fluence at end-of-license. The margin term is defined in 10 CFR 50.61. In accordance with 10 CFR 50.61, ΔRT_{NDT} is a function of neutron fluence. Since neutron fluence changes with time, the determination of ΔRT_{NDT} (and, therefore, RT_{PTS}) meets the TLAA criteria of 10 CFR 54.3(a).

In LRA Section 4.2.2, the applicant discussed its analysis of the Unit 1 and Unit 2 PTS for the period of extended operation. The applicant noted that the Unit 1 PTS analysis includes surveillance data from the analysis of Capsule Y, which was pulled from the Unit 1 RV in the spring of 2000. Likewise, the applicant noted that the PTS analysis for Unit 2 includes surveillance data from the analysis of Capsule X, which was pulled from the Unit 2 RV in the spring of 2005. The latest surveillance capsule reports provided by the applicant are WCAP-15571, “Analysis of Capsule Y from Beaver Valley Unit 1 Reactor Vessel Radiation Surveillance Program,” Revision 0, November 2000, and WCAP-16527-NP, “Analysis of Capsule X from First Energy Nuclear Operating Company Beaver Valley Unit 2 Reactor Vessel Radiation Surveillance Program,” Revision 0, March 2006. The applicant also referenced WCAP-15571, Supplement 1, July 2007, for Unit 1 and WCAP-16527-NP, Supplement 1, July 2007, for Unit 2.

These supplements contain detailed calculations of the RT_{PTS} and upper shelf energy (USE) values for the end of the period of extended operation (54 EFPYs), based on the latest surveillance data. The applicant stated that the Unit 1 and Unit 2 RT_{PTS} calculations follow the requirements specified in 10 CFR 50.61. The applicant also discussed its RT_{PTS} calculations for the limiting RV beltline material at Unit 1.

The limiting beltline material at Unit 1 is Lower Shell Plate B6903-1 (Heat No. C6317-1). According to the applicant, the RT_{PTS} value for this material at the end of the period of extended operation is 275.7 °F, which exceeds the 270 °F PTS screening limit for plates. The applicant determined that the 270 °F screening limit for this material will be reached at a fluence level of $4.961 \times 10^{19} n/cm^2$ (E > 1.0 MeV). The applicant projected that this fluence level will be reached in the year 2033 (43.87 EFPYs). The applicant stated that the RT_{PTS} values for all other RV beltline materials at Unit 1 and the RT_{PTS} values for all RV beltline materials at Unit 2 are projected to meet the PTS screening criteria of 10 CFR 50.61. Likewise, all extended beltline materials for Unit 1 and Unit 2 will meet the 10 CFR 50.61 screening criteria.

The applicant provided RT_{PTS} values for beltline materials in LRA Tables 4.2-5 and 4.2-6 for Unit 1 and Unit 2, respectively. These tables included all the input data required to determine the RT_{PTS} values at the end of the period of extended operation, including the weight percentage copper and nickel, initial RT_{NDT} values, chemistry factor values, clad/base metal interface fluence values, fluence factors, M values, and margin component terms (σ_i and σ_Δ). The staff independently confirmed that the applicant utilized valid weight percentages for copper and nickel, and initial RT_{NDT} values for the Unit 1 and Unit 2 RV beltline materials. For all RV beltline materials represented in the Unit 1 and Unit 2 RV surveillance programs, as well as those represented in sister plant surveillance programs, the applicant provided two sets of RT_{PTS} calculations. The first calculation was based on the use of the chemistry factor tables from 10 CFR 50.61 (hereafter designated as RG 1.99, Revision 2, RP 1.1 – the equivalent ART methodology). The second calculation was based on the application of the surveillance data (hereafter designated as RG 1.99, Revision 2, RP 2.1). Only one of these two methods may be used for calculating licensing basis chemistry, ART, and RT_{PTS} values for each material, and the applicant did not indicate which of the two calculations represented their proposed licensing basis.

In RAI 1, dated March 5, 2008, the staff requested that the applicant indicate which RP (RP 1.1 or RP 2.1) was used to determine the licensing basis chemistry factor, ART, and RT_{PTS} values for each RV beltline material. The staff also requested that the applicant justify its selection of RPs 1.1 or 2.1 for each material, based on factors such as surveillance data credibility or non-credibility, conservatism of RP 2.1 data, or other factors, such as a previous staff recommendation that non-credible surveillance data be used for calculating the chemistry factor for limiting plate B6903-1 with full σ_{Δ} margin of 17 °F.

In its response dated April 2, 2008, the applicant stated that in all cases where credible surveillance data are available at Unit 1 and Unit 2, the more conservative of the two RPs is used for determining the licensing basis chemistry factor, ART, and RT_{PTS} values for the material. Specifically, the RP 1.1 or 2.1 resulting in the higher set of values (chemistry factor, ART, and RT_{PTS}) is taken to supersede the RP resulting in the lower set of values for each RV beltline material represented. Furthermore, the applicant stated that for the Unit 1 limiting RV beltline material (Lower Shell Plate B6903-1 (Heat No. C6317-1)), the non-credible surveillance data were used with full σ_{Δ} margin of 17 °F for determining the CF, ART, and RT_{PTS} values.

In this instance, the use of the non-credible surveillance data with full σ_{Δ} margin of 17 °F results in higher and, therefore, more conservative chemistry factor, ART, and RT_{PTS} values than those which would be obtained using RP 1.1. The staff finds that this is consistent with the February 12, 1998, NRC-Industry meeting where the staff recommended that the applicant, in this instance, utilize the non-credible surveillance data with a full σ_{Δ} margin of 17 °F for this plate, because it yields appropriately conservative results. This was also confirmed by the applicant's statement in LRA Section 4.2.2 that the RT_{PTS} value for the Unit 1 limiting RV beltline material, Lower Shell Plate B6903-1, is 275.7 °F at the end of the period of extended operation.

Based on its review, the staff concludes that for all Unit 1 and Unit 2 RV beltline materials, the applicant has utilized the RP that yields the most appropriate results. The staff finds the applicant's response to RAI 1 acceptable because the applicant provided the necessary information regarding their implementation of RP 1.1 or 2.1 for determining the licensing basis chemistry factor, ART, and RT_{PTS} values for the RV beltline materials at Unit 1 and Unit 2 and justified the use of the RP methodology based on maintaining adequate conservatism for these calculations. Therefore, the staff's concern described in RAI 1 is resolved.

For Unit 1, the staff noted several discrepancies between LRA Section 4.2.2, LRA Table 4.2-5, Appendix D of WCAP-15571 (Surveillance Data Credibility Analysis), and WCAP-15571, Supplement 1, regarding the application of surveillance data for determining the RT_{PTS} value for

Intermediate Shell Longitudinal Weld 19-714 (Heat 305424). First, WCAP-15571, Appendix D, Page D-5 states, “The surveillance weld [Heat 305424] has two out of four data points outside the 28 °F scatter band. Hence, the surveillance data is not credible.”

In RAI 2, dated March 5, 2008, the staff requested that the applicant reconcile this statement with the statement in LRA Section 4.2.2, Page 4.2-6, the second paragraph, which indicates that the “data for the Unit 1 surveillance program weld material is deemed credible” and the similar statement in WCAP-15571, Supplement 1, Section 6.1, indicating that “the data for the surveillance program weld material is deemed credible.” The staff noted that the applicant must address the fact that WCAP-15571, Appendix D, shows that two of the four surveillance data points (Capsules V and Y) for Intermediate Shell Longitudinal Weld 19-714 (Heat 305424) fall outside of the 28°F ΔRT_{NDT} scatter band.

In addition to the above discrepancy, the staff noted that in LRA Section 4.2.2, Page 4.2-6, the second paragraph states that the data for the Unit 1 surveillance program weld material was “used with a σ_{Δ} margin of 14°F.” Likewise, WCAP-15571, Supplement 1, Section 6.1 indicates that “The [surveillance program weld] data was used with a σ_{Δ} margin of 14°F.” Therefore, the staff also requested that the applicant reconcile these statements with the 28°F value for σ_{Δ} presented in LRA Table 4.2-5 for Intermediate Shell Longitudinal Weld 19-714, based on RP 2.1.

In its response to RAI 2, dated April 2, 2008, the applicant acknowledged that the statements in LRA Section 4.2.2, Page 4.2.6, the second paragraph and WCAP-15571, Supplement 1, Section 6.1 are incorrect because these statements indicate (1) that the data for the surveillance program weld material (Heat No. 305424) at Unit 1 are credible and (2) that the Unit 1 surveillance weld data were used with a σ_{Δ} value of 14°F. The applicant stated that corrections to LRA Section 4.2.2 were made to indicate (1) that the Unit 1 surveillance weld data are non-credible and (2) a σ_{Δ} value of 28°F is used for the corresponding RV weld (Intermediate Shell Longitudinal Weld 19-714).

These changes to LRA Section 4.2.2 were implemented in accordance with LRA Amendment No. 5, dated April 2, 2008. The applicant provided a regulatory commitment (Regulatory Commitment 1) to incorporate these same changes in WCAP-15571, Supplement 1, Section 6.1, by September 30, 2008.

Based on its review, the staff finds the applicant’s response to RAI 2 acceptable because the applicant has corrected the information in LRA Section 4.2.2 regarding the credibility of the Unit 1 surveillance weld data and the σ_{Δ} value for the corresponding RV weld with LRA Amendment 5. Furthermore, the applicant has committed to correcting the statements in WCAP-15571, Supplement 1, Section 6.1, regarding the credibility of the surveillance weld and the proper value for the σ_{Δ} term. Therefore, the staff’s concern described in RAI 2 is resolved.

The staff noted that Intermediate-to-Lower Shell Circumferential Weld 11-714 (Heat 90136) and Lower Shell Longitudinal Weld 20-714 (Heat 305414) are not represented in the Unit 1 surveillance program. However, chemistry factor and RT_{PTS} values for these welds based on RP 2.1 were reported in LRA Table 4.2-5.

In RAI 3, dated March 5, 2008, the staff requested that the applicant provide additional information concerning its use of surveillance data for these welds. First, the staff requested that the applicant confirm whether the heats for these welds are represented in the surveillance programs for St. Lucie, Unit 1 (St. Lucie 1) (Heat 90136) and Fort Calhoun (Heat 305414). Second, the staff requested that the applicant indicate whether these surveillance data sets were deemed credible in accordance with RG 1.99, Revision 2, and provide references for the documents where the analyses for determining credibility (or non-credibility) may be found. Finally, the staff requested that the applicant indicate whether the chemistry factors for these welds, based on RP 2.1 (84.8 for Intermediate-to-Lower Shell Circumferential Weld 11-714 and 223.9 for Lower Shell Longitudinal Weld 20-714), were calculated by adjusting the measured ΔRT_{NDT} values by the ratio of the chemistry factor for the vessel weld to the chemistry factor for the surveillance weld, as prescribed in RG 1.99, Revision 2. If the ΔRT_{NDT} values were properly adjusted for determining these chemistry factor values, the staff requested that the applicant provide the chemistry factor ratio adjustment factors for these welds or a reference for the document where these adjustment factors may be obtained. If the ΔRT_{NDT} values were not adjusted for determining these chemistry factor values, the staff requested that the applicant modify LRA Table 4.2-5 and the Unit 1 PTLR to include chemistry factor calculations based on RP 2.1 for these welds that account for this adjustment.

In its response to RAI 3 dated April 2, 2008, the applicant confirmed that the heats for Unit 1 Intermediate-to-Lower Shell Circumferential Weld 11-714 (Heat No. 90136) and Lower Shell Longitudinal Weld 20-714 (Heat No. 305414) are represented in the surveillance programs for sister plants St. Lucie 1 and Fort Calhoun, respectively. The applicant indicated that the credibility analysis for the St. Lucie 1 surveillance data can be found in WCAP-15446, “Analysis of Capsule 284° from the Florida Power & Light Company St. Lucie Unit 1 Reactor Vessel Radiation Surveillance Program,” September 2000. This analysis determined that the surveillance data for this weld heat (Heat No. 90136) is credible. The applicant indicated that the credibility analysis for the Fort Calhoun surveillance weld Heat No. 305414 can be found in WCAP-15571, Appendix D, which also provides the credibility analyses for the surveillance materials at Unit 1. This analysis determined that the surveillance data for this weld is not credible. The staff reviewed the above credibility analyses for the St. Lucie 1 and Fort Calhoun surveillance weld data and determines that the applicant accurately assessed the credibility of the surveillance data for these weld heats.

With respect to the chemistry factor ratio adjustments to the measured ΔRT_{NDT} values for this surveillance data, the applicant indicated that the chemistry factor ratio adjustment procedure was applied to account for chemistry differences between the Unit 1 RV welds and the St. Lucie 1 and Fort Calhoun surveillance welds, respectively.
The applicant indicated that the chemistry factor ratio adjustment procedures can be found in WCAP-15570, “Beaver Valley Unit 1 Heatup and Cooldown Limit Curves for Normal Operation,” Revision 2, which documents the P-T limit curve calculations for Unit 1. The staff independently confirmed the validity of these adjustments and that they were correctly applied to the measured ΔRT_{NDT} values for these surveillance welds.

Based on its review, the staff finds the applicant’s response to RAI 3 acceptable because the applicant has provided all of the requested information and supporting documentation regarding its analysis and implementation of surveillance weld data for St. Lucie 1 Heat No. 90136 and Fort Calhoun Heat No. 305414. Therefore, the staff’s concern described in RAI 3 is resolved.

The applicant indicated in LRA Section 4.2.2 that a neutron flux management program is in place at Unit 1 for ensuring that the limiting RV beltline material, Lower Shell Plate B6903-1, meets the PTS screening requirements of 10 CFR 50.61 at the end of the current 40-year license term. The staff was unclear whether these same measures for managing neutron flux will maintain the RT_{PTS} value for the limiting material within the 10 CFR 50.61 PTS screening limits, until the year 2033 (43.87 EFPYs); the time, as documented in LRA Section 4.2.2, when the limiting material will reach the 270 °F PTS screening limit.

In RAI 5, dated March 5, 2008, the staff requested that the applicant indicate whether the limiting material is projected to reach the 270°F screening limit requirement of 10 CFR 50.61 in the year 2033 (43.87 EFPYs), under this same flux management program. If the current flux management program will not maintain the limiting material below the PTS screening limit until 2033 (43.87 EFPYs), the staff requested that the applicant discuss any additional measures required to ensure that the limiting material does not exceed the PTS screening limit until 2033 (43.87 EFPYs). Furthermore, the staff noted that LRA Section 4.2.2 states that documentation of a flux reduction program for Unit 1 will be submitted in accordance with the requirements of 10 CFR 50.61. Therefore, the staff also requested in RAI 5 that the applicant provide a formal commitment to submit the appropriate documentation of its program for maintaining the limiting RV beltline material (Plate B6903-1) at Unit 1 below the 10 CFR 50.61 PTS screening criterion through the end of the period of extended operation (54 EFPYs) and that this commitment include a schedule for submitting this documentation.

In its response to RAI 5, dated April 2, 2008, the applicant stated that the RT_{PTS} value for the limiting RV beltline material at Unit 1 (Lower Shell Plate B6903-1) will reach the 270°F screening limit (as specified in 10 CFR 50.61) at a fluence level of 4.961 x 1019 n/cm2 (E > 1.0 MeV). The applicant verified that this limiting fluence level (corresponding to an RT_{PTS} value of 270°F) will be reached for the limiting material at 43.87 EFPYs and that the limiting material RT_{PTS} value will reach 275.7°F at the end of the period of extended operation (54 EFPYs), if mitigating actions above and beyond the current neutron flux management program are not implemented. The applicant further stated that Unit 1 will reach 43.87 EFPYs in 2033, assuming a 90% capacity factor. In the second part of its response to RAI 5, the applicant stated that it has provided a formal commitment to submit the appropriate documentation of its plan for maintaining the limiting Unit 1 RV beltline material (Lower Shell Plate B6903-1) below the required 10 CFR 50.61 screening limit, through the end of the period of extended operation (54 EFPYs). This license renewal future commitment is provided in LRA Appendix A, Table A.4-1, under Item No. 24, and reads as follows:

> “Prior to exceeding the PTS screening criteria for BVPS Unit 1, FENOC [the applicant] will select a [neutron] flux reduction measure to manage PTS in accordance with the requirements of 10 CFR 50.61. A flux reduction plan will be submitted for NRC review and approval at least 1 year prior to implementation of the flux reduction measure.”

The staff determines that this commitment meets the requirements of 10 CFR 50.61 for plants projected to exceed the PTS screening criteria at end-of-license under existing operating conditions. The staff further determines that 10 CFR 50.61(b)(3) explicitly permits such plants to implement future flux reduction programs that will maintain the limiting RT_{PTS} value below the applicable PTS screening limit, and that the applicant’s future submittal of its flux reduction plan at least one year prior to implementation will allow sufficient time for staff review of these flux reduction measures. In addition to this commitment, the applicant revised LRA Sections 4.2.2 and A.2.2.2 (UFSAR Supplement for PTS) to indicate that the flux reduction plan will be submitted for staff review and approval at least one year prior to implementation of the flux reduction measure. These changes to LRA Sections 4.2.2 and A.2.2.2 were implemented in accordance with LRA Amendment No. 5 dated April 2, 2008.

Based on its review, the staff finds the applicant's response to RAI 5 acceptable because the applicant has provided (1) the requested information regarding the suitability of current flux management programs for maintaining the RT_{PTS} value for the limiting Unit 1 RV beltline material below the 10 CFR 50.61 screening criteria until 2033 (43.87 EFPYs), and (2) the requested formal commitment regarding a flux reduction plan to manage PTS that demonstrates compliance with the requirements of 10 CFR 50.61. Therefore, the staff's concern described in RAI 5 is resolved.

The staff noted that WCAP-16527-NP, Appendix D, "Analysis of Capsule X from First Energy Nuclear Operating Company Beaver Valley Unit 2 Reactor Vessel Radiation Surveillance Program," Revision 0 indicated that the data for the surveillance weld at Unit 2 (Heat No. 83642) were not adjusted by the ratio of the chemistry factor for the vessel weld to the chemistry factor for the surveillance weld, as prescribed in RG 1.99, Revision 2, for ART and RT_{PTS} calculations based on RP 2.1. Therefore, in RAI 7 dated March 5, 2008, the staff requested that the applicant verify whether the copper and nickel content of the surveillance weld differs from that of the RV welds at Unit 2. If a difference in chemistry exits, the staff requested that the applicant modify LRA Section 4.2.2, LRA Table 4.2-6, and the Unit 2 PTLR to account for the chemistry factor ratio adjustment.

In its response to RAI 7, dated April 2, 2008, the applicant indicated that WCAP-16527-NP, Appendix D addresses only the credibility evaluation of the surveillance materials. The Unit 2 surveillance weld data were not adjusted by the chemistry factor ratio in this report. However, weight percentage copper and nickel values for the Unit 2 RV welds are different from the weight percentage copper and nickel values for the corresponding surveillance weld (Heat No. 83642).

According to the applicant, WCAP-15677-NP, "Beaver Valley Unit 2 Heatup and Cooldown Limit Curves for Normal Operation," August 2001, documents the P-T limit curve calculations for Unit 2 which includes a RV weld to surveillance weld chemistry factor ratio calculation. WCAP-15677-NP, Tables 4-5 and 4-6, also specify best estimate values for weight percentage copper and nickel for the Unit 2 RV welds and corresponding surveillance weld. These weight percentage copper and nickel values result in chemistry factor values of 34.4 for the RV welds and 38 for the corresponding surveillance weld. The resulting RV weld to surveillance weld chemistry factor ratio is 0.905. In WCAP-15677-NP, this chemistry factor ratio was conservatively set to 1.0 for the actual RP 2.1 chemistry factor calculations. When the chemistry factor ratio is conservatively set to 1.0, the resulting RP 2.1 chemistry factor is 12.5, and the applicant used this value in LRA Section 4.2.2 for the RT_{PTS} calculations that were based on RP 2.1. The staff confirms that the actual chemistry factor value for the Unit 2 surveillance weld is 38 which results in a chemistry factor ratio of 0.905. Therefore, the applicant's RP 2.1 calculations based on a chemistry factor ratio of 1.0 for this weld are conservative.

The staff finds the applicant's response to RAI 7 acceptable because the applicant has provided sufficient explanation regarding its implementation of the chemistry factor ratio adjustment procedure for the Unit 2 RV weld embrittlement calculations. Therefore, the staff's concern described in RAI 7 is resolved.

Based on its review of the applicant's RT_{PTS} calculations and their response to RAIs 1, 2, 3, 5, and 7 dated April 2, 2008, as documented above, the staff finds that the applicant has accurately calculated the 54 EFPY RT_{PTS} values for all RV beltline materials and has correctly used applicable surveillance data for determining that the non-limiting Unit 1 RV beltline materials and all Unit 2 RV beltline materials will remain in compliance with the requirements of 10 CFR 50.61, through the end of the period of extended operation (54 EFPYs). The staff also finds that the applicant has provided an acceptable commitment regarding the future submittal of a flux reduction plan to manage PTS for the Unit 1 limiting RV beltline material that demonstrates compliance with the requirements of 10 CFR 50.61.

4.2.2.3 UFSAR Supplement

In LRA Sections A.2.2.2 (Unit 1) and A.3.2.2 (Unit 22), the applicant provided UFSAR Supplement summary descriptions for the PTS TLAA. The applicant has amended LRA Section A.2.2.2 for the Unit 1 PTS UFSAR Supplement in accordance with its April 2, 2008 RAI response. The staff reviewed the applicant's PTS UFSAR Supplement summary descriptions, as amended, for Unit 1 and Unit 2 and determines they are consistent with the PTS TLAA in LRA Section 4.2.2, as amended. The PTS UFSAR Supplements summarize the applicable 10 CFR 50.61 PTS screening requirements. The Unit 1 UFSAR Supplement summary description states that the PTS TLAA at Unit 1 will be adequately managed for the period of extended operation in accordance the requirements in 10 CFR 54.2(c)(1)(iii). The Unit 2 UFSAR Supplement summary description states that the RV beltline materials for Unit 2 will comply with the applicable requirements in 10 CFR 50.61, as projected through the end of the period of extended operation. Therefore, the staff determines that the Unit 1 and Unit 2 UFSAR Supplement summary descriptions for the PTS TLAA are acceptable.

4.2.2.4 Conclusion

Based on its review, the staff determines that (1) the PTS TLAA at Unit 1 will be managed in accordance with Commitment No. 24 to ensure compliance with 10 CFR 50.61, through the end of the period of extended operation; and (2) the RV beltline materials at Unit 2 are projected to remain in compliance with the PTS requirements in 10 CFR 50.61, through the end of the period of extended operation. The staff concludes that the applicant's (1) TLAA for PTS at Unit 1 is in compliance with 10 CFR 54.21(c)(1)(iii); (2) TLAA for PTS at Unit 2 is in compliance with 10 CFR 54.21(c)(1)(ii); and (3) safety margins established and maintained during the current operating term will be maintained during the period of extended operation, as required by 10 CFR 54.21(c)(1). The staff also concludes that the UFSAR Supplements, as amended, for Unit 1 and Unit 2 contain appropriate summary descriptions of the TLAA for PTS for the period of extended operation, as required by 10 CFR 54.21(d).

4.2.3 Charpy Upper Shelf Energy

4.2.3.1 Summary of Technical Information in the Application

In LRA Section 4.2.3, the applicant summarized the evaluation of C_vUSE for the period of extended operation. According to RG 1.99, Figure 2, without surveillance data, C_vUSE

presumably decreases as a function of fluence and copper content. Linear interpolation is permitted. With surveillance data, the decrease in C_vUSE may be obtained by plotting the reduced plant surveillance data on RG 1.99, Revision 2, Figure 2, and fitting the data with a line drawn parallel to the existing lines as the upper bound of all the data. This line should be preferred to the existing graph. The C_vUSE is predictable by use of the corresponding T/4 fluence projection, the copper content of the beltline materials, the results of the capsules tested to date by RG 1.99, Revision 2, Figure 2, or a combination of each. RV beltline materials must have an initial C_vUSE of no less than 75 ft-lb and must maintain C_vUSE of no less than 50 ft-lb throughout the life of the vessel.

4.2.3.1.1 Unit 1

In the spring of 2000, Surveillance Capsule Y was pulled for analysis documented in WCAP-15571. For license renewal, WCAP-15571, Supplement 1, documents the end-of-license-extended analysis for C_vUSE.

For Unit 1, there are material surveillance data for RV lower shell plate B6903-1 (heat C6317-1) and the intermediate shell longitudinal weld (heat 305424). The applicant plotted the measured drops in C_vUSE for each of these material heats on RG 1.99, Revision 2, Figure 2, with a horizontal line drawn parallel to the existing lines as the upper bound of all data and used RG 1.99, Revision 2, Figures 1 and 2 to determine the percent decrease in C_vUSE for the beltline and extended beltline materials. LRA Table 4.2-7 shows C_vUSE values at end-of-license-extended (54 EFPYs) for Unit 1 beltline materials. The applicant evaluated the extended beltline materials likely to receive fluence values greater than 1.0E+17 n/cm^2 (E>1.0 MeV) and determined that none of these materials were limiting. The beltline and extended beltline material C_vUSE values maintain 50 ft-lb or greater at 54 EFPYs; therefore, disposition of the Unit 1 C_vUSE analysis complies with 10 CFR 54.21(c)(1)(ii).

4.2.3.1.2 Unit 2

In the spring of 2005, Surveillance Capsule X was pulled for analysis documented in WCAP-16527-NP. For license renewal, WCAP-16527-NP, Supplement 1, documents the end-of-license-extended analysis for C_vUSE. For Unit 2, there are material surveillance data for RV intermediate shell plate B9004-2 (heat C0544-2) and the intermediate shell longitudinal weld (heat 83642). The applicant plotted the measured drops in C_vUSE for each of these material heats on RG 1.99, Revision 2, Figure 2, with a horizontal line drawn parallel to the existing lines as the upper bound of all data and used RG 1.99, Revision 2, Figures 1 and 2 to determine the percent decrease in C_vUSE for the beltline and extended beltline materials.

LRA Table 4.2-8 shows C_vUSE values at end-of-license-extended (54 EFPYs) for the Unit 2 beltline materials. The beltline material C_vUSE values maintain 50 ft-lb or greater at 54 EFPYs. The applicant also evaluated extended beltline materials likely to receive fluence values greater than 1.0E+17 n/ cm^2 (E>1.0 MeV). The extended beltline material C_vUSE values maintain 50 ft-lb or greater at 54 EFPYs; therefore, disposition of the Unit 2 C_vUSE analysis complies with 10 CFR 54.21(c)(1)(ii).

4.2.3.2 Staff Evaluation

The staff reviewed LRA Section 4.2.3 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

Appendix G of 10 CFR 50 provides fracture toughness requirements for ferritic materials (low alloy steel or carbon steel) in the RCPB, including C_vUSE requirements for ensuring adequate safety margins against ductile tearing. The staff's acceptance criteria are based on (1) GDC-14, which requires that the RCPB be designed, fabricated, erected, and tested so as to have an extremely low probability of rapidly propagating fracture; (2) GDC-31, which requires that the RCPB be designed with a safety margin sufficient to assure that, under specified conditions, it will behave in a non-brittle manner and the probability of a rapidly propagating fracture is minimized; (3) 10 CFR Part 50, Appendix G, which specifies fracture toughness requirements for ferritic components of the RCPB; and (4) 10 CFR 50.60, which requires compliance with 10 CFR Part 50, Appendix G.

Appendix G of 10 CFR 50 also provides the staff's criteria for maintaining acceptable levels of C_vUSE for RV beltline materials throughout the licensed operational lives of reactor facilities. The rule requires RV beltline materials to have a minimum C_vUSE value of 75 ft-lb in the unirradiated condition, and to maintain a minimum C_vUSE value above 50 ft-lb throughout the life of the facility; unless, it can be demonstrated through analysis that lower values of C_vUSE would provide acceptable margins of safety against fracture equivalent to those required by the American Society of Mechanical Engineers (ASME) Code Section XI, Appendix G. The rule also mandates that the methods used to calculate C_vUSE values must account for the effects of neutron radiation on the C_vUSE values for the materials and must incorporate any relevant RV surveillance capsule data that are reported through implementation of a plant's RV materials surveillance program, pursuant to 10 CFR 50, Appendix H. The staff's recommended guidelines for calculating the effects of neutron radiation on the C_vUSE for the RV beltline materials are specified in RG 1.99, Revision 2. The C_vUSE value for a material at a given fluence level can be determined based on the initial (unirradiated) C_vUSE value for the material and a percentage decrease in C_vUSE that may be calculated using the procedures in RG 1.99, Revision 2. The percentage decrease in C_vUSE may be determined using RG 1.99, Revision 2, Figure 2, in accordance with RP 1.2 or from credible surveillance data pursuant to RP 2.2.

The C_vUSE for a material decreases as a function copper content and neutron fluence. Since neutron fluence changes with time, the determination of C_vUSE complies with 10 CFR 54.3(a) for being a TLAA.

In LRA Section 4.2.3, the applicant discussed the Unit 1 and Unit 2 C_vUSE calculations for the period of extended operation (54 EFPYs). The applicant noted that the Unit 1 C_vUSE calculations address surveillance data from the analysis of Surveillance Capsule Y, which was pulled from the Unit 1 RV in the spring of 2000. Likewise, the C_vUSE calculations for Unit 2 address surveillance data from the analysis of Surveillance Capsule X, which was pulled from the Unit 2 RV in the spring of 2005. The applicant stated that all of the RV beltline and extended beltline materials at Unit 1 and Unit 2 are projected to maintain C_vUSE values greater than 50 ft-lb through the end of the period of extended operation.

The applicant provided 54 EFPY C_vUSE calculations for the Unit 1 and Unit 2 RV beltline materials in LRA Tables 4.2-7 and 4.2-8. These tables included all the input data required to determine the C_vUSE values at the end of the period of extended operation, including the weight percentage copper, initial C_vUSE values, and 1/4T fluence values. The staff independently confirmed that the applicant utilized valid weight percent copper and initial C_vUSE values for the Unit 1 and Unit 2 RV beltline materials. The applicant calculated the projected 54 EFPY C_vUSE values in accordance with RG 1.99, Revision 2, RP 2.2, for all RV beltline materials represented in the RV surveillance programs at Unit 1 and Unit 2. C_vUSE calculations for all other RV beltline materials at Unit 1 and Unit 2 were based on RG 1.99, Revision 2, RP 1.2. Surveillance data from sister plants, St. Lucie 1 and Fort Calhoun, were not used in the Unit 1 C_vUSE calculations. The staff also independently confirmed that the applicant correctly calculated the 54 EFPY C_vUSE values and that all of these C_vUSE values are greater than 50-lb, as required by 10 CFR Part 50, Appendix G. In addition, the staff calculated 54 EFPY C_vUSE values based on RG 1.99, Revision 2, RP 1.2 for all of the Unit 1 and Unit 2 RV beltline materials represented in the RV surveillance programs (*i.e.*, those materials with C_vUSE values calculated using RP 2.2). This was done in order to confirm that these materials would meet the 50-ft-lb C_vUSE requirement even without application of the surveillance data, which yield non-conservative results. With the exception of Lower Shell Plate B6903-1 at Unit 1, all RV beltline materials represented in the applicant's surveillance programs maintained C_vUSE values greater than 50 ft-lb, when calculated using RP 1.2. For Unit 1, the staff found that the C_vUSE for Lower Shell Plate B6903-1 (the limiting material) when calculated using RP 2.1, is approximately 49.8 ft-lb (*i.e.* slightly less than the minimum allowable value). The applicant calculated a C_vUSE value of 51.5 ft-lb for the Unit 1 limiting plate based on RP 2.2. Therefore, in RAI 6, dated March 5, 2008, the staff requested that the applicant explain why the surveillance data were deemed credible for determining the 54 EFPY C_vUSE value for this plate, based on the criteria for surveillance data credibility from RG 1.99, Revision 2.

In its response to RAI 6, dated April 2, 2008, the applicant stated that the scatter of the C_vUSE surveillance data for Lower Shell Plate B6903-1 is small enough to permit the determination of the C_vUSE unambiguously. The applicant indicated that WCAP-15571, Supplement 1, documents the calculation of the 54 EFPY C_vUSE value for this plate, based on application of the surveillance data in accordance with RP 2.2. The applicant discussed this calculation in detail. The staff had previously confirmed the accuracy of this calculation; however, it was clear to the staff upon closer review that the C_vUSE surveillance data for this plate was sufficient to result in a reliable calculation of the 54 EFPY C_vUSE.
Based on its review, the staff concludes that the applicant has correctly determined that the surveillance data for Lower Shell Plate B6903-1 was credible for application to the C_vUSE calculation for this plate. Therefore, the staff's concern in RAI 6 is resolved.

Based on its review of the applicant's C_vUSE calculations and response to RAI 6 as documented above, the staff finds that the applicant has accurately calculated the 54 EFPY C_vUSE values for all RV beltline materials. The staff also finds the applicant has correctly used applicable surveillance data for determining that the Unit 1 and Unit 2 RV beltline materials will maintain C_vUSE values greater than 50 ft-lb, through the end of the period of extended operation (54 EFPYs), in accordance 10 CFR Part 50, Appendix G. Therefore, the staff's concern described in RAI 6 is resolved.

4.2.3.3 UFSAR Supplement

In LRA Sections A.2.2.3 (Unit 1) and A.3.2.3 (Unit 2), the applicant provided UFSAR Supplement summary descriptions for the TLAA of the C_vUSE. The staff reviewed the applicant's C_vUSE UFSAR Supplement summary descriptions for Unit 1 and Unit 2 and determines they are consistent with the TLAA for the C_vUSE in LRA Section 4.2.3. The UFSAR Supplement summary descriptions summarize the applicable C_vUSE requirements that must be met to ensure continued compliance with 10 CFR 50, Appendix G. They also state that the RV beltline materials for Unit 1 and Unit 2 will comply with the applicable requirements in 10 CFR 50, Appendix G, as projected through the end of the period of extended operation. Therefore, the staff determines that the Unit 1 and Unit 2 UFSAR Supplement summary descriptions for the TLAA on C_vUSE are acceptable.

4.2.3.4 Conclusion

Based on its review, the staff determines that the applicant projects that the RV beltline materials at Unit 1 and Unit 2 will remain in compliance with the C_vUSE requirements in 10 CFR 50, Appendix G, through the end of the period of extended operation. Therefore, the staff concludes that the applicant's TLAA for the C_vUSE is in compliance with 10 CFR 54.21(c)(1)(ii) and that the safety margins established and maintained during the current operating term will be maintained during the period of extended operation, as required by 10 CFR 54.21(c)(1). The staff also concludes that the UFSAR Supplements for Unit 1 and Unit 2 contain appropriate summary descriptions of the TLAA of the C_vUSE for the period of extended operation, as required by 10 CFR 54.21(d).

4.2.4 Pressure-Temperature Limits

4.2.4.1 Summary of Technical Information in the Application

In LRA Section 4.2.4, the applicant summarized the evaluation of P-T limits for the period of extended operation. Appendix G of 10 CFR Part 50 requires that RV boltups, hydrotests, pressure tests, normal operations, and anticipated operational occurrences be accomplished within P-T limits established by calculations that utilize the materials and fluence data from the reactor surveillance capsule analyses. P-T limits calculated for several years into the future remain valid for an established period of time, not to exceed the current operating license term.

The applicant's P-T limit curves are operating limits, conditions of the operating license, and are included in the pressure and temperature limits report, as required by TSs. They are valid up to a stated vessel fluence limit and must be revised prior to operation beyond that limit. The latest PTLR submitted to the staff for each unit was on March 31, 2005. The power uprate review evaluated the continued applicability of each unit's P-T limits.

Appendix G of 10 CFR Part 50 requires the applicant to operate within the currently licensed P-T limit curves, which must be maintained and updated as necessary for plant operation in accordance with 10 CFR Part 50. The Reactor Vessel Integrity Aging Management Program will maintain the P-T limit curves for both units for the period of extended operation; therefore, disposition of the Unit 1 and Unit 2 P-T limit curves TLAAs is in accordance with 10 CFR 54.21(c)(1)(iii).

The applicant states that the Low-Temperature Overpressure Protection System is known as the Overpressure Protection System (OPPS). Updates for both units reviews the OPPS setpoints (temperature and power-operated relief valve setpoints), as required, based on the updated P-T limit curves.

4.2.4.2 Staff Evaluation

The staff reviewed LRA Section 4.2.4 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Appendix G of 10 CFR Part 50 provides fracture toughness requirements for ferritic materials (low alloy steel or carbon steel) materials in the RCPB, including requirements for calculating P-T limits for the plant. 10 CFR Part 50, Appendix G requires that RCPB materials satisfy the criteria in ASME Code Section XI, Appendix G, in order to ensure the structural integrity of the RCPB during any condition of normal operation, including anticipated operational occurrences and hydrostatic tests. Acceptance criteria for P-T limits are based on (1) GDC-14, which requires that the RCPB be designed, fabricated, erected, and tested as to have an extremely low probability of rapidly propagating fracture; (2) GDC-31, which requires that the RCPB be designed with a safety margin sufficient to assure that, under specified conditions, it will behave in a nonbrittle manner and the probability of a rapidly propagating fracture is minimized; (3) 10 CFR Part 50, Appendix G, which specifies fracture toughness requirements for ferritic components of the RCPB; and (4) 10 CFR 50.60, which requires compliance with 10 CFR Part 50, Appendix G.

Section IV.A.2 of 10 CFR Part 50, Appendix G requires that P-T limits for operating reactors be at least as conservative as those that would be generated using the calculation methods specified in ASME Code Section XI, Appendix G. The rule also requires that P-T limit calculations account for the effects of neutron radiation on the properties of the RV beltline materials and that these calculations incorporate any relevant RV surveillance capsule data that are required for compliance as part of the applicant's implementation of its 10 CFR Part 50, Appendix H RV materials surveillance program. The staff's recommended guidelines for calculating the effects of neutron radiation on the RV beltline material properties, specifically the ART values used for calculating P-T limits, are specified in RG 1.99, Revision 2. P-T limits are usually calculated based on the ART value for the limiting RV beltline material. The ART for a material increases as a function of neutron fluence. Since neutron fluence changes with time, the P-T limits meet the requirements of 10 CFR 54.3(a) for being a TLAA.

In LRA Section 4.2.4, the applicant discussed the P-T limits for Unit 1 and Unit 2 which are documented in the Unit 1 and Unit 2 PTLRs, "Beaver Valley Power Station Unit No. 1 Pressure and Temperature Limits Report," Revision 4, September 19, 2007, and "Beaver Valley Power Station Unit No. 2 Pressure and Temperature Limits Report," Revision 2, June 25, 2007, respectively. The contents of the Unit 1 and Unit 2 PTLRs are controlled in accordance with TS requirements. The TSs for Unit 1 and Unit 2 require that the applicant operate the reactor coolant system (RCS) within the limits specified in the PTLRs and that PTLRs be updated for each RV fluence period or for any revision or supplement thereto. The P-T limits in the current revisions of the Unit 1 and Unit 2 PTLRs are valid up to the RV fluence levels corresponding to operating periods explicitly specified in the reports. In accordance with TS requirements, the applicant will update the PTLRs for new fluence limits prior to operating beyond the current periods. The Unit 1 and Unit 2 TS requirements concerning RCS operation and the contents of the PTLRs ensure that the structural integrity of the RCPB will be maintained in accordance with 10 CFR Part 50, Appendix G. Additionally, the applicant specified that the Reactor Vessel Integrity Program described in LRA Section B.2.35 will maintain the Unit 1 and Unit 2 P-T limit curves to ensure compliance with 10 CFR Part 50, Appendix G, through the end of the period of extended operation (54 EFPYs).

The staff reviewed the contents of the Unit 1 and Unit 2 PTLRs and determines that, in general, they contain the data necessary to ensure compliance with TS requirements and the requirements of 10 CFR Part 50, Appendix G. However, the staff noted several anomalies in the PTLRs requiring further clarification from the applicant. Unit 1 PTLR Table 5.2-5 states that the chemistry factor for Lower Shell Plate B6903-1 is 147.2 (based on RP 1.1). This is the incorrect chemistry factor for this plate, per the February 12, 1998, NRC-Industry meeting, where the NRC recommended that the non-credible surveillance data for this *specific* plate be used along with a full σ_Δ value of 17 °F for RT_{PTS} and ART calculations. LRA Section 4.2.2 accurately reflects that the non-credible surveillance data and full σ_Δ value of 17°F were used to arrive at a 54 EFPY RT_{PTS} value of 275.7°F, based on a RP 2.1 chemistry factor value of 149.2. Furthermore, PTLR Table 5.2-7 provides ART calculations for this limiting plate that are based on the correct chemistry factor value of 149.2 and states that these calculations are based on the non-credible plate surveillance data and full σ_Δ value of 17°F. The staff noted that the application of surveillance data and the selection of chemistry factors for calculation of RT_{PTS} and ART values in the Unit 1 PTLR should be consistent with the LRA. Therefore, in RAI 4 dated March 5, 2008, the staff requested that the applicant explain why Unit 1 PTLR Table 5.2-5 showed a chemistry factor value of 147.2 for Lower Shell Plate B6903-1 instead of the correct chemistry factor value of 149.2.

In its response to RAI 4, dated April 2, 2008, the applicant stated that Unit 1 PTLR Table 5.2-5 should not show a chemistry factor value 149.2 for Lower Shell Plate B6903-1 because this table only applies to chemistry factor calculations based on RG 1.99, Revision 2, RP 1.1. A chemistry factor value of 147.2, based on RP 1.1, is the correct chemistry factor value for this table. The applicant indicated that the Unit 1 PTLR Table 5.2-4 shows chemistry factor calculations based on the use of surveillance data. The staff reviewed the Unit 1 PTLR Table 5.2-4 and finds that the chemistry factor for Lower Shell Plate B6903-1 was correctly calculated at 149.2, based on the application of the non-credible surveillance data with a full $\sigma_\Delta$value of 17°F. Furthermore, the staff noted that the titles for these tables adequately reflect the applicant's intent to calculate chemistry factors in accordance with both RPs found in RG 1.99, Revision 2, for RV beltline materials represented in the surveillance program. This strategy, whereby the applicant calculates chemistry factors based on RPs 1.1 and 2.1 and, selects the more conservative factor, is consistent with the LRA chemistry factor calculations for the PTS TLAA discussed in SER Section 4.2.2.

For Unit 2, the staff noted that LRA Section 4.2.2, LRA Table 4.2-6, and WCAP-16527-NP, Supplement 1 all incorporate data from the evaluation of Surveillance Capsules U, V, W, and X. However, the staff noted that the Unit 2 PTLR only incorporates data from the evaluation of Surveillance Capsules U, V and W. The application of surveillance data and the selection of chemistry factors for calculation of RT_{PTS} and ART values in the Unit 2 PTLR should be consistent with the LRA. As the Unit 2 PTLR forms part of the basis for the LRA, the staff requested in RAI 8, dated March 5, 2008, that the applicant update the Unit 2 PTLR to incorporate the results from the evaluation Surveillance Capsule X.

In its response to RAI 8, dated April 2, 2008, the applicant stated that the latest Unit 2 PTLR (Revision 2) was associated with implementation of the applicant's Improved TS Conversion License Amendment for Unit 2. Therefore, the Unit 2 PTLR only incorporated data from the evaluation of Surveillance Capsules U, V, and W. The applicant addressed the discrepancy between the LRA and the current revision of the Unit 2 PTLR by adding a regulatory commitment to submit to the staff by September 30, 2008, an updated PTLR that incorporates the results from the analysis of Surveillance Capsule X. This commitment was provided as Commitment No. 2 in Enclosure 1 to the applicant's April 2, 2008 RAI response. The staff reviewed this commitment and determines that the applicant has ensured that the Unit 2 PTLR will be updated in a timely manner to incorporate the results from the analysis of Surveillance Capsule X. Therefore, the staff's concern described in RAI 8 is resolved.

Based on its review of the applicant's P-T limits TLAA in LRA Section 4.2.4, Unit 1 and Unit 2 PTLRs, and the applicant's responses to RAIs 4 and 8, as documented above, the staff finds that the applicant has adequately demonstrated that the P-T limits at Unit 1 and Unit 2 will be managed to ensure compliance with 10 CFR Part 50, Appendix G through the end of the period of extended operation. Therefore, the staff's concerns described in RAIs 4 and 8 are resolved.

4.2.4.3 UFSAR Supplement

In LRA Sections A.2.2.4 (Unit 1) and A.3.2.4 (Unit 2), the applicant provided UFSAR Supplement summary descriptions for the P-T limits TLAA. The staff reviewed the applicant's P-T limits UFSAR Supplement summary descriptions for Unit 1 and Unit 2 and determines they are consistent with the TLAA for the P-T limits in LRA Section 4.2.3. The UFSAR Supplement summary descriptions summarize the applicable fracture toughness requirements that must be met to ensure continued compliance with 10 CFR Part 50, Appendix G. They also state that the P-T limits for Unit 1 and Unit 2 will be managed through the implementation of the Reactor Vessel Integrity Aging Management Program to ensure compliance with 10 CFR Part 50, Appendix G, through the end of the period of extended operation. Therefore, the staff determines that the Unit 1 and Unit 2 UFSAR Supplement summary descriptions for the P-T limits TLAA are acceptable.

4.2.4.4 Conclusion

The staff reviewed the applicant's TLAA for the P-T limits, as summarized in LRA Section 4.2.4, including its RAI responses dated April 2, 2008, and determines that the P-T limits at Unit 1 and Unit 2 will be managed through the applicant's implementation of the Reactor Vessel Integrity Aging Management Program to ensure compliance with the requirements in 10 CFR Part 50, Appendix G, through the end of the period of extended operation. Therefore, the staff concludes that the applicant's TLAA for the P-T limits is in compliance with the acceptance criterion for TLAAs pursuant to 10 CFR 54.21(c)(1)(iii) and that the safety margins established and maintained during the current operating term will be maintained during the period of extended operation, as required by 10 CFR 54.21(c)(1). The staff further concludes that the UFSAR

Supplements for Unit 1 and Unit 2 contain appropriate summary descriptions of the P-T limits TLAA for the period of extended operation, as required by 10 CFR 54.21(d).

4.3 Metal Fatigue

Unit 1 Class 1 components evaluated for fatigue include:

- Reactor vessel
- Control rod drive mechanisms
- Reactor vessel internals
- Pressurizer
- Replacement steam generators
- Reactor coolant pumps
- Loop stop valves

The applicant stated in the LRA that the design and analysis of the Unit 1 main coolant loop piping, including the pressurizer surge line, initially complied with American National Standards Institute (ANSI) B31.1. The reanalysis of the pressurizer surge line complied with ASME Code Section III to account for stratification issues in accordance with the guidance in NRC Bulletin 88-11. No other Unit 1 piping systems were designed and analyzed pursuant to ASME Code Section III.

Unit 2 Class 1 components evaluated for fatigue include:

- Reactor vessel
- Control rod drive mechanisms
- Reactor vessel internals
- Pressurizer
- Steam generators
- Reactor coolant pumps
- Loop stop valves
- Piping (main coolant loop piping, pressurizer surge line, pressurizer safety and relief valve piping, and Class 1 portions of various systems (e.g., residual heat removal (RHR), chemical and volume control, and safety injection) integral with the RCS

The Unit 2 reactor head vent and RV level instrumentation system piping also comply with ASME Code Section III Class 1, but are exempt from full fatigue analysis as they are 1-inch or less diameter.

Non-Class 1 component types within the scope of license renewal evaluated for fatigue include:

- Piping
- Tubing
- Fittings
- Tanks
- Vessels

- Heat exchangers
- Valve bodies and bonnets
- Pump casings
- Miscellaneous process components

10 CFR 54.21(c) requires an evaluation of TLAAs to demonstrate that the analyses remain valid for the period of extended operation, the analyses have been projected to the end of the period of extended operation, or the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

LRA Section 4.3 includes the following information:

- Section 4.3.1 addresses Class 1 fatigue TLAAs.
- Section 4.3.2 addresses Non-Class 1 fatigue TLAAs.
- Section 4.3.3 addresses both the fatigue TLAAs responsive to NRC Bulletins 88-08 and 88-11 and the effects of the primary coolant environment on fatigue life.
- Section 4.3.4 addresses the transients for calculation of fatigue usage factors for the ASME Code Class 1 components. For this set of cyclic design transients, the applicant compiled the cycles accrued to October 2003 and projected the cycles expected at the end of 60 years of operation to keep the results below the number of design-allowable cycles.

4.3.1 Class 1 Fatigue

The applicant stated that the design of Unit 1 and Unit 2 Class 1 components incorporates the ASME Code Section III requirement of a discrete analysis of the thermal and dynamic stress cycles on components that make up the RCPB. The fatigue analyses rely on the definition of "design-basis transients" that envelope the expected cyclic service and the calculation of a cumulative usage factor (CUF). In accordance with ASME Code Section III, Subsection NB, the CUF must not exceed 1.0. The applicant also stated that the required analysis for Unit 1 and Unit 2 incorporated a set of design-basis transients based on the original 40-year operating life of the plant. The ASME Code Section III, Class 1 fatigue evaluations in the specific piping and component analyses are TLAAs based on a number of design cycles assumed for the life of each plant.

In UFSAR Tables 4.1-10 and 3.9N-1, the applicant showed the original design-basis transients, including RCS design cycles for Unit 1 and Unit 2 and replicated those findings in LRA Table 4.3-2, which also lists operational cycles anticipated to occur during 60 years of plant life. The applicant further stated that it reviewed the design cycles against 60-year projected operational cycles and determined that the design cycles are bounding for the period of extended operation, except in specific cases described in the following three subsections. The applicant concluded that since it used the 60-year projected operational cycles to determine that the design fatigue analyses remain valid for 60 years, the Metal Fatigue of Reactor Coolant Pressure Boundary Program must continue to validate the assumptions for these analyses. Therefore, disposition of Class 1 components and piping fatigue TLAAs, except in specific cases described in the following sections, is in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(iii).

4.3.1.1 Unit 2 RHR Piping and Unit 2 Charging Line

4.3.1.1.1 Summary of Technical Information in the Application

In LRA Section 4.3.1.1, the applicant summarized its evaluation of Unit 2 RHR piping and the Unit 2 charging line for the period of extended operation. The applicant stated that projected Unit 2 RHR piping and the Unit 2 charging line cycles of operation will exceed their design cycles during the period of extended operation. The Metal Fatigue of Reactor Coolant Pressure Boundary Program will monitor the transient cycles for the Unit 2 RHR piping and the Unit 2 charging line. The applicant also stated that the program will take corrective actions as required to ensure that the design bases of the these components are not exceeded for the period of extended operation and concluded that the disposition of the Unit 2 RHR piping and the Unit 2 charging line fatigue TLAAs complies with 10 CFR 54.21(c)(1)(iii).

4.3.1.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.1 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In LRA Table 4.3-2, the applicant provided the cycle counts as of October 15, 2003, and the estimated cycle counts at 60 years of plant operation for design transients. The applicant indicated that the design cycles are bounding for the period of extended operation, except in certain cases. The staff noted the statement in LRA Section 4.3.1.1, “Unit 2 RHR piping and Unit 2 charging line cycles of operation are projected to exceed their respective design cycles during the period of extended operation.” In RAI B.2.27-4, dated May 28, 2008, the staff requested that the applicant justify the discrepancy between the text in the LRA onsite basis documents and LRA Table 4.3-1, Annotation (a). In addition, in RAI B.2.27-7, also dated May 28, 2008, that staff requested that the applicant (1) specify the major components affected by the critical and supplemental transients and, confirm that the fatigue analysis on these components has been updated to include these transients; (2) justify the consistency between those supplemental transients and design transients noted in the design specification and; (3) explain the method for monitoring these transients and indicate whether the number of design cycles for the supplemental transients will remain valid for the period of extended operation.

In response to RAI B.2.27-4, dated July 11, 2008, the applicant stated that for the location with the Annotation (a), RHR System Piping, the transient of concern is “Placing RHR in Service” and occurs at approximately 350 ^{o}F , during plant shutdown procedures. As documented in WCAP-16173-P, the applicant stated that Westinghouse initially counted this transient assuming an occurrence each time the plant transitioned from Mode 3 (Hot Standby) to Mode 4 (Hot Shutdown). The staff verified in the applicant’s UFSAR and TSs that the RHR was placed into service during the transition between Mode 3 and Mode 4. The applicant noted that this method of counting transients is dependent on an accurate account of the plant modes and the transition between Mode 3 and Mode 4. To obtain an accurate count of the plant mode history, the applicant evaluated data obtained from Power Ascension Testing, through October 15, 2003. The applicant’s recount analysis resulted in 31 events compared to the Westinghouse count of 85 events. The staff compared the results of the applicant’s recount with LRA Table 4.3-2 and noted that Unit 2 had 30 plant cooldown cycles.

The staff further noted that the new recount performed by the applicant was reasonable because the transient “Placing RHR in Service” would have occurred at least every time the plant experienced the transient “Plant Cooldown” (*i.e.*, when the plant transitioned from Mode 3 to Mode 4). On this basis, the staff finds the applicant’s response acceptable.

In response to RAI B.2.27-7, dated July 11, 2008, the applicant indicated that all the supplemental transients listed in the LRA are applicable to both Unit 1 and Unit 2. The applicant identified those components affected by each of the transients (pressurizer insurge/outsurge, selected chemical and volume control system (CVCS), auxiliary feedwater (AFW) injection and RHR activation). The staff noted that the applicant specified the applicable analyses for the components and incorporated the corresponding transients affecting them. Therefore, with the exception of the ASME Class 1 portion of the Unit 2 charging piping, no revision is required. The applicant committed (Regulatory Commitment No. 1) to perform reanalyses for the ASME Class 1 portion of the Unit 2 charging piping and to incorporate the revised design cycles of the selected CVCS transients. The applicant stated the AFW injection transient was incorporated into the original analysis for the Unit 2 reactor coolant pumps, pressurizer and loop stop valves. However, Westinghouse did not identify this transient in the nuclear steam supply system (NSSS) transients; therefore, it was not a part of the original design basis. The applicant specifically added this transient for the steam generators as part of the design basis for the extended power uprate. The staff noted that the RHR activation for Unit 2 was part of the original design basis and considered a supplemental transient, because the applicant expected that the cycles would exceed the design cycles. However, based on its response to RAI B.2.27-4, the applicant no longer expects these cycles to exceed the design cycles.

The staff noted in the applicant’s response to RAI B.2.27-7, that the applicant is capable of monitoring the pressurizer insurge/outsurge, selected CVCS and AFW injection transients with its plant computer data archiving system. The staff noted that with the use of the plant computer, the applicant can identify the pressurizer insurge/outsurge transient via the surge line thermocouple, which detects a delta-temperature, and allocate it into a pre-existing band of delta-temperatures. The applicant explained that the plant computer identifies selected CVCS transients by noting the valve positions and the AFW injection transient by noting the operation and system flow rates of the AFW pumps during Plant Mode 1, 2 and 3. As discussed in the staff’s evaluation of RAI B.2.27-4, RHR activation can be identified when the plant transitions between Mode 3 and Mode 4.

Based on its review of the applicant’s responses to RAIs B.2.27-4 and B.2.27-7, the staff finds that the applicant has provided sufficient detail pertaining to the supplemental transients, the components affected by these transients and the method for monitoring and identifying these transients, through the period of extended operation. By letter dated October 2, 2008, the applicant completed the re-analysis and provided the results and methodology which demonstrated that the CUF, including environmental factors for the BVPS charging piping will remain below the code allowable limit of 1.0. The staff noted this revised analysis incorporated new and revised thermal transients reflecting the operating experience at BVPS Unit 2. Therefore, the staff’s concerns described in RAIs B.2.27-4 and B.2.27-7 are resolved.

4.3.1.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of Unit 2 RHR piping and Unit 2 charging line in LRA Section A.3.3.1.1. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address Unit 2 RHR piping and Unit 2 charging line is adequate.

4.3.1.1.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that, for Unit 2 RHR piping and Unit 2 charging line, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.2 Unit 2 Steam Generator Manway Bolts and Tubes

4.3.1.2.1 Summary of Technical Information in the Application

LRA Section 4.3.1.2 summarizes the evaluation of Unit 2 steam generator manway bolts and tubes for the period of extended operation. The applicant could not demonstrate the validity of the original design fatigue calculations through the period of extended operation for the following Unit 2 steam generator subcomponents:

- Steam generator secondary manway bolts
- Steam generator tubes (U-bend fatigue)

The applicant stated that the Unit 2 steam generator secondary manway bolt and the steam generator tube fatigue analyses are based on a 40-year life (current operating license expires in 2027). The extended power uprate temperature average coastdown analysis for the secondary manway bolts assumed replacement of the Unit 2 steam generators by the year 2027. The uprate analyses for the U-bends assumed replacement of the Unit 2 steam generators by the year 2027. The applicant further stated that the Steam Generator Tube Integrity Program will reanalyze, repair, or replace the affected components so their design bases are not exceeded for the period of extended operation; therefore, disposition of the Unit 2 steam generator secondary manway bolts and the Unit 2 steam generator tubes fatigue TLAAs complies with 10 CFR 54.21(c)(1)(iii).

4.3.1.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.2 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In LRA Section 4.3.1.2, the applicant indicated that it will perform a reanalysis, repair, or replacement of the affected Unit 2 steam generator manway bolts and tubes as part of an aging management program (AMP). The staff noted that the applicant also made a commitment (Commitment No. 26) in LRA Table A.5-1. However, the staff noted that the AMP description provided in LRA Section B.2.27 does not indicate the reanalysis, repair, or replacement of the above mentioned components. In RAI 4.3.2, dated May 28, 2008, the staff requested that the applicant explain the discrepancy between LRA Section 4.3.1.2 and LRA Section B.2.27.

In its response to RAI 4.3.2, dated July 11, 2008, the applicant amended LRA Section 4.3.1.2 to indicate that the Metal Fatigue of Reactor Coolant Pressure Boundary Program will be enhanced to include reanalysis, repair or replacement of the Unit 2 steam generator manway bolts and tubes. The applicant also appropriately amended LRA Section B.2.27 and LRA Table A.5-1 to include this enhancement (Commitment No. 26). The staff further noted that as part of the extended power uprate, the applicant assumed that the steam generators would be replaced prior to year 2027, and as a result, were not reanalyzed for the period of extended operation. As such, these components will be monitored under the Metal Fatigue of Reactor Coolant Pressure Boundary Program and corrective actions, which include reanalysis, repair or replacement, will be taken in order to ensure that the design basis of these components are not exceeded during the period of extended operation.

Based on its review, the staff finds the applicant’s response to RAI 4.3-2 acceptable because the applicant amended the LRA to address the discrepancy described above and has committed (Commitment No. 26) to reanalyze, repair or replace those components specified above as part of the Metal Fatigue of Reactor Coolant Pressure Boundary Program so that the appropriate corrective actions will be taken to ensure that the effects of aging on the intended functions of these components will be adequately managed for the period of extended operation. Therefore, the staff’s concern described in RAI 4.3.2 is resolved.

4.3.1.2.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of Unit 2 steam generator manway bolts and tubes in LRA Section A.3.3.1.2. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant’s actions to address Unit 2 steam generator manway bolts and tubes is adequate.

4.3.1.2.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that, for Unit 2 steam generator manway bolts and tubes, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.1.3 Unit 1 and Unit 2 Pressurizers

4.3.1.3.1 Summary of Technical Information in the Application

In LRA Section 4.3.1.3, the applicant summarized its evaluation of Unit 1 and Unit 2 pressurizers for the period of extended operation. The applicant stated that a revision to the analysis of the Unit 1 pressurizer, lower shell, and related components in 1999 addressed improvements to the insurge/outsurge transients found by the Westinghouse Owners Group

(WOG). The applicant further stated that it had revised plant operating procedures to follow the guidance of the WOG, to minimize the impact of potential insurges. Prior to the 1999 reanalysis, Unit 1 experienced several pressurizer spray transients that challenged the analytical and TS limit of 320 °F difference between the spray line and the pressurizer steam space temperatures. The applicant incorporated revised transients in its analysis for initial spray flow and in 2005, decided to revise the operating procedures further to optimize the plant shutdown and startup processes.

The applicant stated that the optimized procedures meet all recommendations of the WOG and virtually eliminate the potential for insurges. Next, the applicant utilized the Extended Power Uprate Project to evaluate the revised uprate transients against its previous analysis. The Unit 1 pressurizer CUFs are less than 1.0.

The applicant also stated that in 2000, its revised analysis of the Unit 2 pressurizer, lower shell, and related components addressed the insurge/outsurge transients found by the WOG. Revised plant operating procedures followed the guidance of the WOG to minimize the impact of potential insurges. In 2002, the applicant decided to revise the operating procedures further to optimize the Unit 2 shutdown and startup processes. The applicant stated that its optimized procedures met all recommendations of the WOG and virtually eliminated the potential for insurges. The applicant then utilized the Extended Power Uprate Project to evaluate the revised uprate transients against the previous analysis. Because some operating parameters had changed, the applicant revised its analysis of the Unit 2 pressurizer, lower shell, and related components. In addition, the Pressurizer Weld Overlay Project had the potential to impact the pressurizer spray nozzle, the safety valve nozzles, the pressure-operated relief valve nozzle, and the surge line nozzle, during the Unit 2 refueling outage (RFO) 12 (October - November 2006). The applicant submitted a supplement to the subject analysis to address the weld overlay for the surge nozzle. The Unit 2 pressurizer CUFs are less than 1.0.

The applicant further stated that it had determined that the design fatigue analyses for the pressurizers remain valid for 60-years, using the 60-year projected operational cycles; thus, the Metal Fatigue of Reactor Coolant Pressure Boundary Program must continue to validate the assumptions in the evaluations. In addition, the pressurizer insurge cycle assumptions in the pressurizer analyses require validation for the period of extended operation. The Metal Fatigue of Reactor Coolant Pressure Boundary Program treats the pressurizer insurge as a supplemental transient requiring monitoring; therefore, disposition of the pressurizer fatigue TLAAs is in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.3.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.3 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In LRA Section 4.3.1.3, the applicant stated that it had evaluated the pressurizer components, considering the revised extended power uprate transients, against the pervious analysis. The applicant calculated the revised CUFs associated with the pressurizer and found that they were less than the design allowable limit of 1.0. The applicant also indicated that it had used the 60-year projected operational cycles to calculate whether the design fatigue analyses for the pressurizer remains valid during the period of extended operation. In RAI B.2.27-7, dated May 28, 2008, the staff requested that the applicant (1) provide the major components affected by these transients and an update of the related fatigue analysis; (2) justify the consistency between supplemental transients and design transients; and (3) explain the method used for monitoring these transients and whether the design cycles for the supplemental transients will remain valid for the period of extended operation.

In its response to RAI B.2.27-7, dated July 11, 2008, the applicant clarified that all the supplemental transients listed in the LRA are applicable to both Unit 1 and Unit 2. The applicant continued in its response by listing the components affected by each of the transients; namely, pressurizer insurge/outsurge, selected CVCS, AFW injection and RHR activation transients. The staff noted that the applicant's analyses has incorporated the corresponding transients affecting these components and do not require revision, with the exception of the ASME Class 1 portion of the Unit 2 charging piping. The analyses for the ASME Class 1 portion of the Unit 2 charging piping is part of the applicant's commitment (Regulatory Commitment No. 1) to perform a reanalysis, incorporating the revised design cycles of the selected CVCS transients. The applicant stated that the AFW injection transient was incorporated into the original analysis for the Unit 2 reactor coolant pumps, pressurizer and loop stop valves; however, Westinghouse did not identify this transient in the NSSS transients. Therefore, the AFW injection transient was not a part of the original design basis. The applicant added this transient for the steam generators as part of the design basis for the extended power uprate. The staff noted that the RHR activation for Unit 2 was part of the original design basis, and was considered a supplemental transient because the cycles were expected to exceed the design cycles. However, based on its response to RAI B.2.27-4, the applicant no longer expects these cycles to exceed the design cycles.

The staff noted that the applicant is capable of monitoring the pressurizer insurge/outsurge, selected CVCS and AFW injection transient with its plant computer data archiving system. The staff noted that with the plant computer, the applicant can identify the pressurizer insurge/outsurge transient via the surge line thermocouple, which detects a delta-temperature, and allocate it into a pre-existing band of delta-temperatures. The applicant explained that the plant computer identifies selected CVCS transients by noting the valve positions and the AFW injection transient by noting the operation and system flow rates of the AFW pumps during Plant Modes 1, 2 and 3. As discussed in the staff's evaluation of RAI B.2.27-4, RHR activation can be identified when the plant transitions between Mode 3 and Mode 4.

Based on its review of the applicant's response to RAI B.2.27-7, the staff finds that the applicant has provided sufficient detail pertaining to the supplemental transients, the components affected by these transients and the method for monitoring and identifying these transients, through the period of extended operation. The staff further finds that the applicant has committed (Regulatory Commitment No. 1) to reanalyze the Unit 2 charging piping to incorporate the revised design cycles and has demonstrated that it is capable of identifying and monitoring critical and supplemental transients, and their associated aging effects, through the period of extended operation. Therefore, the staff's concerns described in RAI B.2.27-7 are resolved.

The staff noted that LRA Section 4.3.1.3 describes the Pressurizer Weld Overlay Project for Unit 2 only. In RAI 4.3-4, dated May 28, 2008, the staff requested that the applicant confirm whether the Pressurizer Weld Overlay Project will also be performed for Unit 1 and explain the impact of the weld overlay on the fatigue usage for Unit 1 and Unit 2 for the period of extended operation.

In its response to RAI 4.3-4, dated July 11, 2008, the applicant stated that it had completed the planned structural weld overlay for Unit 1 during RFO 18 (Fall 2007). The staff noted that the scope of work for the Unit 1 Pressurizer Weld Overlay Project was completed after the LRA was submitted. The applicant further explained that the scope of work included the pressurizer spray nozzle, relief nozzle and three safety nozzles, but did not include the pressurizer surge line. The staff confirmed in its Safety Evaluation, "Beaver Valley Power Station, Unit No. 1 – Relief Request No. BV1-PZR-01 Regarding Weld Overlay Repairs on Pressurizer Nozzle Welds (TAC No. MD4828)", dated September 17, 2007, that the pressurizer surge line was not within the scope of the project. The applicant continued to describe that for both Unit 1 and Unit 2 pressurizer nozzles, a fatigue crack growth analyses was performed using the methodology pursuant to ASME Code Section XI. The applicant determined that the impact of the structural weld overlay material on the primary stress qualifications, which include deadweight and dynamic loading, were insignificant. The applicant further stated that the pressurizer nozzles continue to meet the applicable ASME Code Section III requirements.

Based on its review, the staff finds that the applicant has adequately determined the effect of the structural weld overlay material on fatigue usage and has confirmed that the pressurizer nozzles meet the applicable requirements of ASME Code Section III. The staff concludes that the applicant's pressurizer fatigue TLAA will be part of the Metal Fatigue of Reactor Coolant Pressure Boundary Program for Unit 1 and Unit 2; and, in accordance with 10 CFR 54.21(c)(1)(iii), the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. Therefore, the staff's concern described in RAI 4.3-4 is resolved.

4.3.1.3.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of Unit 1 and Unit 2 pressurizers in LRA Sections A.2.3.1.1 and A.3.3.1.3. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address Unit 1 and Unit 2 pressurizers is adequate.

4.3.1.3.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that, for Unit 1 and Unit 2 pressurizers, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.2 Non-Class 1 Fatigue

Non-Class 1 component types evaluated for fatigue include pipe, tubing, fittings, tanks, vessels, heat exchangers, valve bodies and bonnets, pump casings, turbine casings, and miscellaneous process components.

4.3.2.1 Piping and In-Line Components

4.3.2.1.1 Summary of Technical Information in the Application

In LRA Section 4.3.2.1, the applicant summarized its evaluation of piping and in-line components for the period of extended operation. The applicant stated that non-Class 1 piping and in-line components (*e.g.*, fittings and valves) within the scope of license renewal comply with ANSI B31.1 or ASME Code Section III, Subsections NC and ND (*i.e.*, Class 2 or 3). These codes require the application of stress range reduction factors against the allowable stress range when evaluating cyclic secondary stresses (*i.e.*, stresses due to thermal expansion and anchor movements). Components with fewer than 7,000 cycles are limited to the calculated allowable stress range without reduction. Components likely to exceed 7,000 cycles have allowable stress ranges reduced by application of the stress range reduction factor.

The applicant also stated that for non-Class 1 components subject to cracking due to fatigue, it had reviewed system operating characteristics to determine the approximate frequency of any significant thermal cycling. If the number of equivalent full-temperature cycles is below the limit for the original design (usually 7000 cycles), the component is suitable for extended operation. If the number of equivalent full-temperature cycles exceeds the limit, evaluation of the individual stress calculations is required.

The applicant further stated that it had evaluated the validity of this assumption for 60 years of plant operation. Except for the Unit 2 emergency diesel generator (EDG) air start system, the results of this evaluation indicated that the thermal cycle assumption is valid and bounding for 60 years of operation; therefore, the non-Class 1 piping fatigue TLAAs, except the Unit 2 EDG air start subsystem fatigue TLAA, remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

The Unit 2 EDG air start system has components that may be potentially subject to fatigue. The applicant will use the Metal Fatigue of Reactor Coolant Pressure Boundary Program to assess whether the full-temperature cycles limit will be exceeded in 60 years of operation. The applicant stated that with corrective actions as appropriate (including reanalysis, repair, or replacement), the full-temperature cycles of the Unit 2 EDG air start system will not be exceeded during the period of extended operation; therefore, disposition of the Unit 2 EDG air start system fatigue TLAA is in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.2.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.2.1 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses have been projected to the end of the period of extended operation and, pursuant to

10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In LRA Section 4.3.2.1, the applicant discussed its evaluation of non-Class 1 components and indicated that the number of design cycles will remain bounding for the period of extended operation. Therefore, the fatigue analyses remain valid in accordance with the requirements of 10 CFR 54.21(c)(1)(i), with the exception of the Unit 2 EDG air start system. In addition, the applicant stated that for the Unit 2 EDG air start system, "BVPS will perform an assessment to determine whether the full-temperature cycles limit will be exceeded for 60 years of operation." In RAI 4.3-12, dated May 28, 2008, the staff requested that the applicant provide the information on the estimated temperature cycles expected for 60 years of operation and explain how these temperature cycles will be monitored during the period of extended operation.

In its response to RAI 4.3-12, dated July 11, 2008, the applicant amended LRA Section 4.3.2.1 to describe the EDG air start system as a stand-by system that operates only when the air start tank requires a top-off or refill, after it has been discharged. The staff noted that the piping for this system is subjected to heat only during the air compression cycle. The applicant has revised its design analysis to include a new load case which is representative of the observed temperatures during air compression. The applicant's evaluation verified that the stress levels from the new thermal load case are below the endurance limit for the piping material. The staff noted that the applicant has amended LRA Section 4.3.2.1 such that the TLAAs are dispositioned pursuant to 10 CFR 54.21(c)(1)(i) and (ii), only. The staff also noted that the applicant had removed Commitment No. 27, since the EDG Air Start System is now dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).

Based on its review, the staff finds the applicant's response to RAI 4.3-12 acceptable because (1) the applicant has performed an evaluation that incorporates the stress levels associated with piping heating caused during the compressing of the air; (2) the results of this evaluation show that the stress levels are below the endurance limit of the piping material and thus, this TLAA is dispositioned in accordance with 10 CFR 54.21(c)(1)(ii) and the analyses projected to the end of the period of extended operation. Therefore, the staff's concern described in RAI 4.3-12 is resolved.

4.3.2.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of piping and in-line components in LRA Sections A.2.3.2.1 and A.3.3.2.1. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address piping and in-line components is adequate.

4.3.2.1.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i) that the analyses remain valid for the period of extended operation and 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.2.2 Pressure Vessels, Heat Exchangers, Storage Tanks, Pumps, and Turbine Casings

4.3.2.2.1 Summary of Technical Information in the Application

In LRA Section 4.3.2.2, the applicant summarized its evaluation of pressure vessels, heat exchangers, storage tanks, pumps, and turbine casings for the period of extended operation. The applicant stated that the design of non-Class 1 pressure vessels, heat exchangers, storage tanks, pumps, and turbine casings is typically in accordance with ASME Code Section VIII or

Section III, Subsection NC or ND (*i.e.*, Class 2 or 3). Some tank and pump designs meet other industry codes and standards (*e.g.*, American Water Works Association and Manufacturer's Standardization Society), reactor designer specifications, and architect engineer specifications. However, only ASME Code Section VIII, Division 2, and Section III, Subsection NC-3200 design codes include fatigue design requirements. The applicant stated that no detailed fatigue analyses are required due to the conservative requirements ASME Code Section VIII, Division 1, and Section III, Subsection NC-3100/ ND-3000. Cracking due to fatigue is not an aging effect requiring management for those components which do not require fatigue analysis. Fatigue analysis is not required for ASME Code Section VIII, Division I, Section III, Subsection NC-3100 or ND vessels nor for NC/ND pumps and storage tanks (less than 15 psig). The design specification indicates the applicable design code for each component. The applicant described fatigue TLAA dispositions in the following text only for the Unit 2 non-regenerative (letdown), regenerative, and RHR heat exchangers.

The applicant also stated that the Unit 2 non-regenerative (letdown) heat exchanger design complies with ASME Code Section III, Class C (tubes) and Section VIII, Division 1 (shell). Westinghouse Equipment Specification G-679150 defines the transients for the Unit 2 non-regenerative (letdown) heat exchanger. Its fatigue analysis is not bounding for 60 years of operation. The applicant will monitor the Unit 2 non-regenerative (letdown) heat exchanger transients with its Metal Fatigue of Reactor Coolant Pressure Boundary Program and will take corrective actions as appropriate (including reanalysis, repair, or replacement) to ensure that their design basis is not exceeded for the period of extended operation. Therefore, disposition of the Unit 2 non-regenerative (letdown) heat exchanger fatigue TLAA is in accordance with 10 CFR 54.21(c)(1)(iii).

The applicant further stated that the Unit 2 regenerative heat exchanger design complies with ASME Code Section III, Class 2. Westinghouse Equipment Specification G-679150 defines the transients for the Unit 2 regenerative heat exchanger. Its fatigue analysis is not bounding for 60 years of operation. The applicant will monitor the Unit 2 regenerative heat exchanger transients with its Metal Fatigue of Reactor Coolant Pressure Boundary Program and will take corrective actions as appropriate (including reanalysis, repair, or replacement) to ensure that the Unit 2 regenerative heat exchanger design basis is not exceeded for the period of extended operation. Therefore, disposition of the Unit 2 regenerative heat exchanger fatigue TLAA is in accordance with 10 CFR 54.21(c)(1)(iii).

The applicant also stated that the tube side design of the Unit 2 RHR heat exchangers complies with ASME Code Section III, Class 2, while the shell side design complies with ASME Code Section III, Class 3. Westinghouse Equipment Specification G-679150 defines transients applicable to these components. The fatigue analyses for the Unit 2 RHR heat exchangers are not bounding for 60 years of operation. The applicant will monitor the Unit 2 RHR heat exchanger transients with its Metal Fatigue of Reactor Coolant Pressure Boundary Program and will take corrective actions as appropriate (including reanalysis, repair, or replacement) to ensure that the Unit 2 RHR heat exchanger design basis is not exceeded for the period of extended operation. Therefore, disposition of the Unit 2 RHR heat exchanger fatigue TLAA is in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.2.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.2.2 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In LRA Section 4.3.2.2, the applicant indicated that the Metal Fatigue of Reactor Coolant Pressure Boundary Program monitors the transients associated with non-regenerative (letdown) heat exchanger, regenerative heat exchanger, and RHR heat exchangers. However, LRA Section B.2.27 does not indicate that monitoring of the relevant transients will be provided by this AMP. In RAI B.2.27-10, dated May 28, 2008, that staff requested that the applicant (1) provide a list of the transients associated with the heat exchangers; (2) identify which of these transients are monitored by the program; and (3) explain its corrective actions when the current analyses are not bounding for 60 years of operation.

In its response to RAI B.2.27-10, dated July 11, 2008, the applicant clarified that all auxiliary system heat exchangers, which include letdown heat exchanger, regenerative heat exchanger and RHR heat exchangers, for both Unit 1 and Unit 2, are installed on the Class 2 part of the their respective systems and the primary side of these auxiliary heat exchangers are designed in accordance with ASME Section III, Class 2 requirements. The staff noted that since these heat exchangers were designed in accordance with ASME Section III, Class 2 rules, a fatigue analysis pursuant to ASME Section III Class 1 requirements is not applicable.

The staff noted that the expected total number of thermal cycles for the heat exchangers in question will be less than the 7000 thermal cycles required by ASME Class 2 thermal analysis; therefore, monitoring or a fatigue reanalysis is not required. By letter dated July 11, 2008, the applicant amended LRA Sections 4.3.2.2 and A.3.3.2.2 and the associated sub-sections and added LRA Section A.2.3.2.2 to reflect the discussion above. The staff noted that since these heat exchangers are bounded by 7000 equivalent full-temperature cycles for 60 years of operating, they will be no longer dispositioned under 10 CFR 54.21(c)(1)(iii), where the Metal Fatigue of Reactor Coolant Pressure Boundary Program is used for monitoring. The staff further noted that these heat exchangers will be dispositioned under 10 CFR 54.21(c)(1)(i), and that the TLAA remains valid for the period of extended operation.

Based on its review, the staff finds the applicant’s response to RAI B.2.27-10 acceptable because the design of the heat exchangers in question is in compliance with ASME Code Section III, Class 2 rules, and the applicant has evaluated the heat exchangers to ensure that they will not exceed the 7000 equivalent full-temperature cycles. The staff concludes that the heat exchangers will not be monitored under the Metal Fatigue of Reactor Coolant Pressure Boundary Program and pursuant to 10 CFR 54.21(c)(1)(i), analyses will remain valid for the period of extended operation. Therefore, the staff’s concern described in RAI B.2.27-10 is resolved.

4.3.2.2.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of pressure vessels, heat exchangers, storage tanks, pumps, and turbine casings in LRA Section A.3.3.2.2. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address pressure vessels, heat exchangers, storage tanks, pumps, and turbine casings is adequate.

4.3.2.2.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation.

The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.3 Generic Industry Issues on Fatigue

This Section addresses both the applicant's fatigue TLAAs response to NRC Bulletins 88-08 and 88-11 and the effects of the primary coolant environment on fatigue life.

4.3.3.1 Thermal Stresses in Piping Connected to Reactor Coolant Systems (NRC Bulletin 88-08)

4.3.3.1.1 Summary of Technical Information in the Application

In LRA Section 4.3.3.1, the applicant summarized its evaluation of thermal stresses in RCS piping (NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems") for the period of extended operation. The applicant stated that NRC Bulletin 88-08 requested that licensees (1) review their RCS for any unisolable piping subject to temperature distributions which could result in unacceptable thermal stresses and any unisolable RCS piping sections that may have been subjected to excessive thermal stresses and (2) take action so such piping will not be subjected to unacceptable thermal stresses. There is no specific TLAA for Unit 1 and Unit 2 that responds to NRC Bulletin 88-08, except the Unit 2 RHR line analysis.

The applicant also stated that the Unit 2 RHR line stratification analysis required a detailed fatigue evaluation to demonstrate compliance with the design code of record (ASME Code Section III). Based on temperature data in response to NRC Bulletin 88-08, the applicant developed a conservative thermal stratification load case. Typical cycle periods for the thermal stratification events on the Unit 2 RHR lines were six to eight days, equating to approximately 2000 cycles for a 40-year plant life (assuming continuous stratification).
The fatigue analysis incorporated as an additional load, a bounding thermal stratification load which assumed 7000 cycles.

The applicant further stated that projection of the stratification cycles for a 60-year plant life results in 3000 cycles. The 7000 cycles in the fatigue analysis bounds the 60-year projected cycles; therefore, disposition of the Unit 2 RHR line fatigue TLAA is in accordance with 10 CFR 54.21(c)(1)(i).

4.3.3.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.3.1 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation.

The staff reviewed the applicant's response to NRC Bulletin 88-08, (Letter to NRC, Beaver Valley Power Station, Unit No. 1, BV-1 Docket No. 50-334, License No. DPR-66, NRC Bulletin 88-08, February 7, 1990) and Letter to NRC, Beaver Valley Power Station, Unit No. 2, BV-2 Docket No. 50-412, License No. NPF-73, NRC Bulletin 88-08, July 14, 1989), in which the applicant stated that it will continue to monitor temperature until a long term solution is implemented to address the thermal stress in piping connected to RCS. In RAI 4.3-1, dated May 28, 2008, the staff requested that the applicant provide the follow-up actions taken in response to NRC Bulletin 88-08 and indicate whether temperature monitoring will be maintained to address thermal stratification during the period of extended operation.

In its response to RAI 4.3-1, dated July 11, 2008, the applicant provided details of its initial follow-up actions taken after NRC Bulletin 88-08 was issued, and further described the current and planned actions to address thermal stratification in piping connected to the RCS. The applicant stated that after NRC Bulletin 88-08 was issued, it began continuous temperature monitoring with thermocouples in February 1990 for Unit 1 and November 1989 for Unit 2. Monitoring was suspended in 2002 because the temporary instrumentation had become degraded and unreliable. Based on its review of the applicant's response letters to NRC Bulletin 88-08, the staff noted what appeared to be a discrepancy as to when the thermocouple monitoring began at Unit 1 and Unit 2. On August 28, 2008, the staff had a teleconference with the applicant to clarify the start date for thermocouple monitoring. The applicant, by letter dated October 2, 2008, clarified that the dates provided in its response to RAI 4.3-1 referred to the dates when data collection started, and not when data was obtained to establish a baseline. The staff noted that the applicant amended its original response to RAI 4.3-1, which stated that data collection to establish a baseline began in June 1989 for Unit 2 and December 1989 for Unit 1. The staff finds that the applicant has provided an appropriate clarification to the discrepancy in data collection start dates for Unit 1 and Unit 2.

The applicant collected initial data for both Unit 1 and Unit 2 in order to create a baseline temperature profile for each monitored line. Based on its review of the baseline data and subsequent data, the applicant showed that the temperature distribution did not fluctuate enough to create a large delta-temperature between the top and bottom of the pipe location. The applicant further described its actions, including weld inspections, that initially were performed for Unit 1 and Unit 2 during RFO 7 (September 1989) and RFO 1 (March 1989), respectively, and continued in subsequent RFOs. The applicant submitted a table indicating the date and the number of welds inspected during the RFO.

Based on the results of these weld inspections, the staff noted that no repairs were required. The staff further noted that these were the applicant's initial follow-up actions and that the applicant's current actions to address thermal stratification in piping connected to RCS must include its participation in Electric Power Research Institute initiatives that include the Thermal Stratification, Cycling and Striping project (Materials Reliability Program (MRP)-24) and MRP-146. The staff noted that all the piping lines within the scope of NRC Bulletin 88-08 and additional lines not originally within the scope of the NRC Bulletin 88-08 are in the scope of MRP-146 and have been screened. Those piping lines that have not been screened out, pursuant to the guidance in MRP-146, will include a detailed analysis.

The staff also noted that renewed thermocouple monitoring may be required for some of the piping lines, based on results from the detailed analysis. It was not clear to the staff whether the applicant had committed to thermocouple monitoring based on the detailed analysis; therefore, the staff held a teleconference with the applicant on August 28, 2008, in which the applicant stated that it will make a formal commitment to resume required thermocouple monitoring on those piping lines based on results from the detailed analysis. By letter dated October 2, 2008, the applicant committed (Commitments No. 31 and No. 32, for Unit 1 and Unit 2 respectively) to implement those actions that are needed, pursuant to the guidance found in MRP-146. The applicant stated that the “needed actions” for Unit 1 and Unit 2 include screening, detailed analysis, inspection, and temperature monitoring in accordance with the guidance provided in MRP-146. The applicant intends to perform augmented-nondestructive examination inspections during the next RFO at Unit 1 (Spring 2009) and Unit 2 (Fall 2009).

Based on its review of the applicant’s response to RAI 4.3-1, the staff finds that the applicant has taken appropriate actions in response to NRC Bulletin 88-08 and will take appropriate actions to continue to address thermal stratification in piping lines connected to the RCS. The staff also finds that the applicant has committed (Commitments No. 31 and No. 32) to resume required thermocouple monitoring on those piping lines based on the detailed analysis performed pursuant to the guidance of MRP-146. Therefore, the staff’s concern described in RAI 4.3-1 is resolved.

The staff noted that in LRA Section 4.3.3.1, the applicant stated, “Typical cycle periods for thermal stratification events on the Unit 2 RHR lines were six to eight days, which equated to approximately 2000 cycles for a 40-year plant life (assuming the stratification occurred continuously).” In RAI 4.3-7, dated May 28, 2008, the staff requested that the applicant provide the technical basis or its analyses which supports this statement.

In its response to RAI 4.3-7, dated July 11, 2008, the applicant stated that in its response to NRC Bulletin 88-08, Supplement 3, thermocouples were used to monitor the pipe temperatures for indication of thermal stratification for the Unit 2 RHR suction branch line. The staff confirmed in letter dated July 14, 1989, “Beaver Valley Power Station, Unit No. 2; Docket No. 50-412, License No. NPF-73 ; NRC Bulletin 88-08”, and signed by J.D. Sieber, that the Unit 2 RHR suction branch line was instrumented with thermocouples to monitor for indication of thermal stratification and data has shown that stratification is occurring continuously. The applicant stated that based on the temperature data collected from the thermocouples an evaluation was performed which indicated that the typical cycle period for the thermal stratification was 6 to 8 days, assuming the stratification is occurring continuously.

The staff noted that based on the applicant’s evaluation, this is equivalent to approximately 2000 cycles during the course of a 40-year plant life. The applicant stated that its fatigue analysis incorporated an additional load (thermal stratification load) that assumes 7000 cycles. Therefore, the applicant concluded that if the approximate 2000 cycles of stratification were projected to 60 years of operation, resulting in approximately 3000 cycles, the 7000 stratification cycles assumption for the Unit 2 RHR line fatigue analysis will remain valid for the period of extended operation.

Based on its review of the applicant’s response to RAI 4.3-7 and the temperature data collected by the thermocouples, the staff finds that the applicant’s analyses were based on a conservative approach. The staff further finds that the approximate 3000 stratification cycles projected to 60 years of operation is bounded by the 7000 cycles assumed in the fatigue analyses and, 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 4.3-7 is resolved.

4.3.3.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of thermal stresses in piping connected to RCSs (NRC Bulletin 88-08) in LRA Section A.3.3.3.1. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address thermal stresses in piping connected to RCSs (NRC Bulletin 88-08) is adequate.

4.3.3.1.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that, for thermal stresses in piping connected to RCSs (NRC Bulletin 88-08), the analyses remain valid for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.3.2 Pressurizer Surge Line Thermal Stratification (NRC Bulletin 88-11)

4.3.3.2.1 Summary of Technical Information in the Application

In LRA Section 4.3.3.2, the applicant summarized its evaluation of pressurizer surge line thermal stratification for the period of extended operation. NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification," requires a plant-specific or generic demonstration that the pressurizer surge line meets design code requirements for the effects of thermal stratification.

<u>BVPS Unit 1 Evaluation</u>. The applicant stated that it had participated in a WOG program for partial resolution of this issue. The program collected, summarized, and evaluated pressurizer surge line physical and operating data relating to piping layout, supports and restraints, components, size, material, operating history, etc., for all domestic Westinghouse PWRs in conjunction with available monitoring data and plant-specific analyses by Westinghouse.

The applicant also stated that in January 1991, it had submitted and the staff approved WCAP-12727, "Evaluation of Thermal Stratification for the Beaver Valley Unit 1 Pressurizer Surge Line." The applicant reviewed WCAP-12727 for impact resulting from the extended power uprate and performed a detailed analysis at the controlling location (reactor coolant loop (RCL) nozzle) to account for temperature effects of the power uprate. The applicant then calculated a new CUF demonstrated to remain less than the code-allowable limit of 1.0.

<u>BVPS Unit 2 Evaluation</u>. The applicant stated that it had first observed apparent surge line stratification during the Unit 2 hot functional testing which preceded NRC Bulletin 88-11. Based on this observation, the applicant revised its surge line ASME Code Section III analysis of record to evaluate stress and fatigue effects with data from additional instrumentation temporarily installed to monitor pipe and fluid conditions. Subsequently, the applicant contracted with Westinghouse for a complete reanalysis of surge line thermal stratification and striping.

The staff accepted WCAP-12093, "Evaluation of Thermal Stratification for the Beaver Valley Unit 2 Pressurizer Surge Line," as meeting leak-before-break (LBB) requirements and other NRC Bulletin 88-11 concerns for the Unit 2 surge line, and demonstrating that thermal stratification effects do not cause the pressurizer surge line to exceed code-allowable design limits.

The applicant reviewed WCAP-12093 for impact resulting from the extended power uprate and performed a detailed analysis at the controlling location (RCL nozzle) to account for temperature effects of the power uprate. The applicant then calculated a new CUF demonstrated to remain less than the code-allowable limit of 1.0.

BVPS Units 1 and 2 Disposition for License Renewal. The applicant stated that both WCAP-12727 and WCAP-12093 determine the effect of thermal stratification by imposing defined thermal stratification cycles upon the stress and fatigue evaluations. The stratification cycles incorporated into the CUF determination are defined by the 200 heatup and cooldown design transients; therefore, these NRC Bulletin 88-11 analyses are TLAAs in accordance with 10 CFR 54.3. LRA Section 4.3.4 demonstrates that the 200 heatup and cooldown cycles are bounding for 60 years of operation; therefore, disposition of the Unit 1 and Unit 2 pressurizer surge line fatigue TLAAs are in accordance with 10 CFR 54.21(c)(1)(i).

4.3.3.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.3.2 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation.

In LRA Section 4.3.3.2.2, the applicant stated that it had performed a detailed analysis at the controlling location (reactor coolant loop (RCL) nozzle), to account for defined thermal stratification and temperature effects due to the thermal power uprate. Those analyses, which supplemented the applicant's original analyses (WCAP-12727 for Unit 1 and WCAP-12093 for Unit 2), demonstrated the new CUF remain less than the code-allowable limit of 1.0. The staff noted that in LRA Section 4.3.3.2, the applicant stated that those analyses remain valid for the license renewal period and were dispositioned it in accordance with 10 CFR 54.21(c)(1)(i). In RAI 4.3-6, dated May 28, 2008, the staff requested that the applicant provide the basis for this statement.

In its response to RAI 4.3-6, dated July 11, 2008, the applicant amended LRA Sections 4.3.3.2.3, A.2.3.3.1 and A.3.3.3.2 to reflect the pressurizer surge line as dispositioned in accordance with 10 CFR 54.21(c)(1)(iii) rather than 10 CFR 54.21(c)(1)(i). The applicant explained that because it used the 60-year projected operational cycles to determine that the 200 heatup and cooldown transients remain valid for the period of extended operation, the Metal Fatigue of Reactor Coolant Pressure Boundary Program for Unit 1 and Unit 2 must be used to validate this same assumption.

Based on its review, the staff finds the applicant's response to RAI 4.3-6 acceptable because the applicant (1) has amended the LRA to disposition the pressurizer surge line in accordance with 10 CFR 54.21(c)(1)(iii); (2) will monitor this location with the Metal Fatigue of Reactor Coolant Pressure Boundary Program and; (3) will initiate appropriate corrective actions so that the effects of aging on the intended functions of these components are adequately managed for the period of extended operation. Therefore, the staff's concern described in RAI 4.3-6 is resolved.

4.3.3.2.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of pressurizer surge line thermal stratification (NRC Bulletin 88-11) in LRA Sections A.2.3.3.1 and A.3.3.3.2. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address pressurizer surge line thermal stratification (NRC Bulletin 88-11) is adequate.

4.3.3.2.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that, for pressurizer surge line thermal stratification (NRC Bulletin 88-11), the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.3.3 Effects of Primary Coolant Environment on Fatigue Life

4.3.3.3.1 Summary of Technical Information in the Application

In LRA Section 4.3.3.3, the applicant summarized its evaluation of the effects of primary coolant environment on fatigue life for the period of extended operation. Test data indicate that certain environmental conditions (*e.g.*, temperature, oxygen content, strain rate) in the primary systems of light water reactors could cause greater susceptibility to fatigue than would be predicted by fatigue analyses based on the ASME Code Section III design fatigue curves from laboratory tests in air and at low temperatures. Adjustments to failure curves derived from laboratory tests to account for data scatter, size effect, and surface finish may not be sufficient to account for actual plant operating environments.

Study of environmental effects on the fatigue life of selected components was under two generic issues, Generic Safety Issue (GSI)-78, "Monitoring of Fatigue Transient Limits for Reactor Coolant System," and GSI-166, "Adequacy of Fatigue Life of Metal Components." GSI-78, determined whether fatigue monitoring was necessary at operating plants and calculated risk from through-wall cracking of metal components due to fatigue. GSI-166 assessed the significance of more recent fatigue test data on the fatigue life of a sample of components in plants that had analyzed code fatigue design. A fatigue action plan coordinated efforts on fatigue life estimation and addressed ongoing GSI-78 and GSI-166 issues for 40-year plant life.

In closing GSI-166, the staff concluded that the environmental effects on fatigue life are not safety-related through the end of the initial license term. This conclusion was based on two studies. The first, published as NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," applied the fatigue design curves for environmental effects to several plants and specified locations of interest for consideration. The second study, based on a risk analysis on fatigue failures, concluded that environmental effects on core damage frequency are insignificant. These two studies concluded that environmental effects are not a concern for the current license term. Closure of GSI-166 led to GSI-190, “Fatigue Evaluation of Metal Components for 60-Year Plant Life.” In closing GSI-190 on the effects of a reactor water environment on fatigue life, the staff concluded licensees should address the effects of the coolant environment on component fatigue life as they formulate AMPs for license renewal.

In summary, the staff concluded that environmental effects have a negligible impact on core damage frequency and therefore require no generic regulatory action but that environmental effects can increase the frequency of pipe leaks and that applicants for license renewal should address the effects of reactor coolant environment on component fatigue life in their aging management reviews.

The applicant’s management of the environmental effects upon component fatigue life determines limiting locations based on the NRC-sponsored studies reported in NUREG/CR-6260 for reevaluation guided by NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” Section X.M1, to demonstrate maintenance of CUFs at such locations below the code-allowable limit of 1.0.

BVPS Units 1 and 2 NUREG/CR-6260 Location Determination. NUREG/CR-6260 applies the fatigue design curves for environmental effects to several plant designs. As Unit 1 and Unit 2 were designed at different times, the plants are different vintages of Westinghouse-designed plants based on the RCS design code. The Unit 1 RCPB piping design is to ANSI B31.1, and Unit 1 is therefore an older-vintage Westinghouse plant. The RCPB piping for Unit 2 is designed to ASME Code Section III, and Unit 2 is therefore a newer-vintage Westinghouse plant.

Section 5.5 of NUREG/CR-6260 specifies the following component locations as representative for environmental effects for older-vintage Westinghouse plants. These locations and the subsequent calculations directly relevant to Unit 1 are as follows:

- Reactor vessel shell and lower head (shell-to-head transition)
- Reactor vessel inlet and outlet nozzles
- Pressurizer surge line (hot leg nozzle safe end)
- RCS piping charging system nozzle
- RCS piping safety injection nozzle
- RHR system tee

Section 5.4 of NUREG/CR-6260 specifies the following component locations as representative for environmental effects for newer-vintage Westinghouse plants. These locations and the subsequent calculations directly relevant to Unit 2 are as follows:

- Reactor vessel shell and lower head (shell-to-head transition)
- Reactor vessel inlet and outlet nozzles
- Pressurizer surge line (hot leg nozzle safe end)
- RCS piping charging system nozzle (knuckle region)
- RCS piping safety injection nozzle (knuckle region)
- RHR system piping (inlet piping transition)

BVPS Units 1 and 2 NUREG/CR-6260 Location Environmental Fatigue Evaluation. The applicant's evaluation of Unit 1 and Unit 2 NUREG/CR-6260 locations used the guidance of NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low Alloy Steels," and NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels." These reports describe the use of a fatigue life correction factor (F_{en}) to express the effects of the reactor coolant environment upon the material fatigue life. Determination of the expression for F_{en} was through experimental and statistical data. F_{en} for carbon and low alloy steel is a function of fluid service temperature, material sulfur content, fluid-dissolved oxygen, and strain rate. For austenitic stainless steel, F_{en} is a function of fluid service temperature, fluid-dissolved oxygen, and strain rate. Determination of the CUF, including environmental effects (U_{env}), is from the existing 60-year CUF (U_{60}) through the use of the F_{en}:

$$U_{env} = U_{60} * F_{en}$$

In order for the applicant to demonstrate acceptable fatigue life including environmental effects, the CUF, including environmental effects, should remain less than design code-allowable (*i.e.*, U_{env} 1.0). Therefore, the applicant applied F_{en} to the CUFs at the Unit 1 and Unit 2 NUREG/CR-6260 locations and compared the results to the design code-allowable limit. It should be noted that three of the Unit 1 NUREG/CR-6260 locations (charging system nozzle, safety injection nozzle, and the RHR system tee) are designed to the ANSI B31.1 standard, which does not require determination of usage factors for fatigue evaluations. Therefore, re-evaluation of these locations in accordance with ASME Code Section III, 1989 Edition with 1989 Addenda, determined 60-year CUFs, applied the appropriate F_{en} to these CUFs, and compared the results against the ASME Code Section III allowable limit. In LRA Table 4.3-1, the applicant provided detailed results of its evaluations of environmental fatigue.

BVPS Units 1 and 2 Disposition for License Renewal. At several locations (Unit 1 pressurizer surge line and charging system nozzle, Unit 2 pressurizer surge line, charging system nozzle, and RHR system piping), U_{env} exceeded the 1.0 design code-allowable limit. For these locations, the applicant will implement one or more of the following as required by the Metal Fatigue of Reactor Coolant Pressure Boundary Program:

(1) Further refinement of the fatigue analyses to lower the predicted CUFs to less than 1.0

(2) Management of fatigue at the affected locations by an inspection program reviewed and approved by the staff (*e.g.*, inspection intervals to be determined by an acceptable method)

(3) Repair or replacement of the affected locations

If the applicant opts to manage environmental-assisted fatigue during the period of extended operation, it will submit AMP details (scope, qualification, method, and frequency) to the staff prior to the period of extended operation; therefore, the applicant dispositioned the TLAAs for the Unit 1 pressurizer surge line and charging system nozzle and the Unit 2 pressurizer surge line, charging system nozzle, and RHR system piping in accordance with 10 CFR 54.21(c)(1)(iii).

The CUFs, including environmental fatigue at the other limiting locations (Unit 1 RV shell and lower head, RV inlet and outlet nozzles, safety injection nozzle and RHR system tee; Unit 2 RV shell and lower head, RV inlet and outlet nozzles, and safety injection nozzle) remain demonstrably less than the 1.0 design code-allowable limit for the period of extended operation; therefore, the applicant dispositioned the TLAAs for these other locations in accordance with 10 CFR 54.21(c)(1)(ii).

4.3.3.3.2 Staff Evaluation

The staff reviewed LRA Section 4.3.3.3 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In LRA Section 4.3.3.3, the applicant discussed the effects of primary coolant environment on fatigue life. During the audit, the applicant indicated that it will refine its analysis for NUREG/CR-6260 components in the near future. To assist its review, the staff issued RAI 4.3-3, dated May 28, 2008, requesting that the applicant (1) provide the schedule for refining its analysis for the environmental-assisted fatigue of the NUREG/CR-6260 locations in which the CUF, including environmental effects (U_{env}), exceeded the design code allowable value; (2) explain how the calculations for the F_{en}, used to express the effects of the reactor coolant environment, will be performed and specifically, how the transient pairs will be considered in the calculations; and (3) describe the criteria and methodology that will be used to perform the additional analyses in calculating the CUF, including U_{env}, for components that exceed the design code-allowable value of 1.0.

In its response to RAI 4.3-3, dated July 11, 2008, the applicant provided a schedule for the reanalysis of those components where U_{env} exceeded the design code-allowable limit of 1.0. Furthermore, the applicant committed (Regulatory Commitment No. 1) to perform this reanalysis and to submit its results to the staff, along with a summary of how the analysis was performed, no later than October 15, 2008.

The staff noted in the applicant's response to RAI 4.3-3 that the Unit 1 and Unit 2 surge line to hot leg nozzle and charging system nozzle, and the Unit 2 safety injection system nozzle and RHR system piping are all fabricated of stainless steel. The applicant stated that the general methodology it used to calculate the F_{en} was the guidance found in NUREG/CR-5704. The applicant further explained that the fatigue usage is calculated with F_{en} factors applied on each load pair incremental usage for the Unit 1 and Unit 2 surge line to hot leg nozzle only, whereas the bounding F_{en} factor is applied to the design CUF for the remaining locations. The applicant expects that results from the refined reanalysis will be successfully based on the methodology provided in the response for all the locations mentioned above; however, as an alternative analysis for the Unit 1 surge line to hot leg nozzle, the applicant may perform a fracture mechanics analysis in accordance with the general methodology described in NUREG/CR-6934.

NUREG/CR-6934, as noted by the staff, is not endorsed by the NRC. Therefore, the staff held a teleconference with the applicant on September 4, 2008, during which time the staff explained that NUREG/CR-6934 is not endorsed by the NRC and thus the results of the applicant's reanalysis are subject to staff review and approval. By letter dated October 2, 2008, the applicant acknowledged the staff's concern and stated that it had completed the reanalysis of those locations listed in Regulatory Commitment No. 1. The applicant further stated that the CUF included environmental factors from the reanalysis of the Unit 1 and Unit 2 charging system nozzle and determined that the Unit 2 safety injection nozzle and RHR system piping will remain below the code-allowable limit of 1.0 during the period of extended operation. However, for the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle, the applicant stated that the CUF, including environmental factors, exceeded the code-allowable limit of 1.0. The applicant further stated that the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle will be managed by the Metal Fatigue of Reactor Coolant Pressure Boundary Program and is within the scope of Commitments No. 25 and No. 26, for Unit 1 and Unit 2 respectively.

The applicant has since withdrawn Regulatory Commitment No. 1 and the proposed use of NUREG/CR-6934 because the applicant has completed its analysis and has placed the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle within the scope of the Metal Fatigue of Reactor Coolant Pressure Boundary Program. The staff confirmed that the applicant has amended LRA Sections 4.3.3.3.3, Section A.2.3.3.2 and Section A.3.3.3.3 to state that the Metal Fatigue of Reactor Coolant Pressure Boundary Program will manage all NUREG/CR-6260 locations because the 60-year projected operational cycles were used in the design fatigue analysis and will require validation of the assumptions used in the analysis.

On the basis of its review, the staff finds the applicant's response to RAI 4.3-3 acceptable because (1) the applicant has completed the reanalysis and provided the results and methodology in letter dated October 2, 2008, which demonstrated that the CUF, including environmental factors for the NUREG/CR-6260 locations, will remain below the code-allowable limit of 1.0, except for the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle; (2) the applicant will manage the all NUREG/CR-6260 locations, including the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle, with the Metal Fatigue of Reactor Coolant Pressure Boundary Program; and (3) the applicant had calculated the F_{en} factor for those locations requiring reanalysis for stainless steels in accordance with NUREG/CR-5704. Therefore, the staff's concern described in RAI 4.3-3 is resolved.

During the audit, the staff noted in LRA Table 4.3-1 that the 60-year CUF (U_{60}) value as well as the environmental CUF value for the Unit 2 safety injection system is not correct. The staff considered the deletion of the boron injection tank line for Unit 2 and confirmed that these values in LRA Table 4.3-1 do not represent the results for safety injection nozzle to the cold leg. In RAI 4.3-13, dated May 28, 2008, the staff requested that the applicant provide the 60-year CUFs (U_{60}) and environmental-assisted fatigue results for this location as recommended by NUREG/CR-6260.

In its response to RAI 4.3-13, dated July 11, 2008, the applicant stated that this discovery made during the audit is currently being addressed with the FENOC corrective actions program. The staff noted that if the applicant used the design CUF from the correct location, taking into account environmental-assisted fatigue, the usage factor would exceed the code-allowable limit of 1.0. The applicant stated that a reanalysis is required for this NUREG/CR-6260 location and committed (Regulatory Commitment No. 1) to perform the reanalysis for the applicable NUREG/CR-6260 locations, including the safety injection nozzle; and, to submit its results to the staff, along with a summary of how the analysis was performed, no later than October 15, 2008.

On the basis of its review, the staff finds the applicant's response to RAI 4.3-13 acceptable because the applicant has completed its reanalysis and provided the results and methodology to the staff by letter dated October 2, 2008. The staff also finds that the applicant has demonstrated that the CUF, including environmental factors for the NUREG/CR-6260 locations, will remain below the code-allowable limit of 1.0, except for the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle; and that the applicant will manage all NUREG/CR-6260 locations with the Metal Fatigue of Reactor Coolant Pressure Boundary Program. Therefore, the staff's concern described in RAI 4.3-13 is resolved.

In LRA Section 4.3.3.3.2, the applicant stated that three of the NUREG/CR-6260 locations for Unit 1 were re-evaluated in accordance with ASME Section III, 1989 Edition with 1989 addenda to determine the 60-year CUFs. The staff noted that the applicant performed its analysis on the Unit 1 charging nozzle, safety injection nozzle and the RHR system tee in accordance with ASME Section III, 1989 Edition with 1989 addenda because these locations were originally designed pursuant to ANSI B31.1 standards. As a result, usage factors were not determined as part of the fatigue evaluation. In RAI 4.3-15, dated May 28, 2008, the staff requested that the applicant provide the design basis transients and the associated cycles used to calculate the 60-year CUFs (U_{60}) in LRA Table 4.3-1.

In its response to RAI 4.3-15, dated July 11, 2008, the applicant provided the information requested by the staff for the Unit 1 charging nozzle, safety injection nozzle and the RHR system tee. The staff noted that the U_{env} for the Unit 1 charging nozzle exceeded the code-allowable limit of 1.0 when considering environmentally assisted fatigue. The applicant committed (Regulatory Commitment No. 1) to perform a reanalysis for this location. As part of this commitment, the applicant will complete the reanalysis and submit the results to the staff, along with a summary of how the analysis was performed, no later than October 15, 2008. The staff finds this portion of the applicant's response acceptable.

By letter dated October 2, 2008, the applicant submitted the results of its reanalysis of the Unit 1 charging nozzle to the staff. The response detailed the applicant's methodology which demonstrated that the CUF, including environmental factors for the NUREG/CR-6260 locations, will remain below the code-allowable limit of 1.0, except for the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle. The applicant stated that it will manage all NUREG/CR-6260 locations with the Metal Fatigue of Reactor Coolant Pressure Boundary Program and that it had calculated the F_{en} factor for those locations requiring reanalysis for stainless steels in accordance with NUREG/CR-5704.

The applicant further stated in its response to RAI 4.3-15 that it used the applicable design transients from the general piping analysis for Unit 2 for the re-evaluation of the Unit 1 safety injection nozzle and the RHR system tee, in accordance with ASME Section III. The staff noted that Unit 1 was designed pursuant to ANSI B31.1 standards and Unit 2 was designed in accordance with ASME Code Section III. The staff also noted that the applicant utilized the applicable design transients from the general piping analysis from Unit 2 and the design cycles of these transients because of the similarity of design and operation between both units, thus making Unit 2 representative of Unit 1. The staff further noted that there was one exception, the design transient "RHR operation", in which the applicant had increased the design cycles in the fatigue analysis to account for the projected cycles. The staff finds the applicant's response acceptable because the applicant has provided adequate information to the staff explaining which design transients and the number of design cycles were used in its fatigue analysis for the Unit 1 safety injection nozzle and RHR system tee.

Based on its review, the staff finds that the applicant's response to RAI 4.3-15 acceptable because the applicant has committed (Regulatory Commitment No. 1) to reanalyze the Unit 1 charging nozzle and to submit the results and methodology used for the analysis to the staff, no later than October 15, 2008. The staff further finds, by letter dated October 2, 2008, that the applicant has completed its reanalysis of the Unit 1 charging nozzle and has provided the results and methodology which demonstrate that the CUF, including environmental factors for the NUREG/CR-6260 locations, will remain below the code-allowable limit of 1.0, except for the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle. The staff also finds that the applicant will manage all NUREG/CR-6260 locations with the Metal Fatigue of Reactor Coolant Pressure Boundary Program and has calculated the F_{en} factor for those locations that required reanalysis for stainless steels in accordance with NUREG/CR-5704. Therefore, the staff's concern described in RAI 4.3-15 is resolved.

The staff noted that the 60-year CUF (U_{60}) for the Unit 2 RHR system piping in LRA Table 4.3-1 is higher than for Unit 1 and that the Unit 2 RHR system piping is dispositioned pursuant to 10 CFR54.21(c)(1)(iii). During the audit, the applicant indicated that the analysis for the 60-year CUF (U_{60}) will be refined. In RAI 4.3-8, dated May 28, 2008, the staff requested that the applicant explain in detail how the RHR system piping will be managed for aging effects.

In its response to RAI 4.3-8, dated July 11, 2008, the applicant committed (Regulatory Commitment No. 1) to perform a reanalysis for the applicable NUREG/CR-6260 locations, including the Unit 2 RHR system piping, and to submit the results of the reanalysis to the staff, along with a summary of how the analysis was performed, no later than October 15, 2008. The applicant further explained that since Unit 1 and Unit 2 are not the same vintage Westinghouse design, the results of the CUF are not directly comparable.

Based on its review, the staff finds the applicant's response to RAIs 4.3-8 acceptable because the applicant has committed (Regulatory Commitment No. 1) to reanalyze the Unit 2 RHR system piping and to submit the results and methodology used for the analysis to the staff, no later than October 15, 2008. The staff further finds, by letter dated October 2, 2008, that the applicant has completed its reanalysis of the Unit 2 RHR system piping and has provided the results and methodology which demonstrate that the CUF, including environmental factors for the NUREG/CR-6260 locations, will remain below the code-allowable limit of 1.0, except for the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle. The staff also finds that the applicant will manage all NUREG/CR-6260 locations with the Metal Fatigue of Reactor Coolant Pressure Boundary Program and has calculated the F_{en} factor for those locations that required reanalysis for stainless steels in accordance with NUREG/CR-5704. Therefore, the staff's concern described in RAI 4.3-8 is resolved.

In LRA Table 4.3-1 and Section 4.3.3.3, the applicant provided the TLAA disposition for Unit 1 and Unit 2 to address environmental assisted fatigue. The staff noted the TLAAs for some of the locations appeared to be dispositioned pursuant to 10 CFR 54.21(c)(1)(i), but in LRA Section 4.3.3.3, the applicant indicated that these components were dispositioned in accordance with 10 CFR 54.21(c)(1)(ii). In RAI 4.3-9, dated May 28, 2008, the staff requested that the applicant clarify the TLAA dispositions for the each of the NUREG/CR-6260 locations.

In its response to RAI 4.3-9, dated July 11, 2008, the applicant explained that it used the 60-year projected operational cycles in the fatigue evaluations for those locations, where U_{env} has been demonstrated to remain below the code-allowable limit of 1.0 (Unit 1 RV shell and lower head, RV inlet and outlet nozzles, safety injection nozzle and RHR system tee; Unit 2 RV shell and lower head, RV inlet and outlet nozzles) for the period of extended operation. The applicant stated that the Metal Fatigue of Reactor Coolant Pressure Boundary Program must be used to validate the assumptions used in these evaluations and amended LRA Section 4.3.3.3.3 to read that for Unit 1 and Unit 2, all locations recommended by NUREG/CR-6260 will be dispositioned in accordance with 10 CFR 54.21(c)(1)(iii). The applicant further stated that it will reanalyze NUREG/CR-6260 locations in which U_{env} exceeded the code-allowable limit of 1.0; and, committed (Regulatory Commitment No. 1) to perform this reanalysis and submit the results to the staff, along with a summary of how the analysis was performed, no later than October 15, 2008.

By letter dated October 2, 2008 the applicant has (1) completed the reanalysis and provided the results and methodology which demonstrated that the CUF including environmental factors for the NUREG/CR-6260 locations will remain below the code allowable limit of 1.0 except for the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle (2) the applicant will manage all NUREG/CR-6260 locations with the Metal Fatigue of Reactor Coolant Pressure Boundary Program and (3) the applicant calculated the F_{en} factor for those locations that required reanalysis for stainless steels in accordance with NUREG/CR-5704.

Based on its review, the staff finds the applicant's response to RAIs 4.3-9 acceptable because the applicant has dispositioned all of the NUREG/CR-6260 locations in accordance with 10 CFR 54.21(c)(1)(iii) and will use the Metal Fatigue of Reactor Coolant Pressure Boundary Program to adequately manage the aging of these components for the period of extended operation. The staff further finds that the applicant has committed (Regulatory Commitment No. 1) to reanalyze the NUREG/CR-6260 locations in which U_{env} exceeded the code-allowable limit of 1.0. Unit 2 RHR system piping and to submit the results and methodology used for the analysis to the staff, no later than October 15, 2008.

The staff also finds, by letter dated October 2, 2008, that the applicant has completed its reanalysis of the NUREG/CR-6260 locations and has provided the results and methodology which demonstrate that the CUF, including environmental factors for the NUREG/CR-6260 locations, will remain below the code-allowable limit of 1.0, except for the Unit 1 and Unit 2 pressurizer surge line to hot leg nozzle.

In addition, the staff finds that the applicant will manage all NUREG/CR-6260 locations with the Metal Fatigue of Reactor Coolant Pressure Boundary Program and has calculated the F_{en} factor for those locations that required reanalysis for stainless steels in accordance with NUREG/CR-5704. Therefore, the staff's concern described in RAI 4.3-9 is resolved.

4.3.3.3.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of effects of the primary coolant environment on fatigue life in LRA Sections A.2.3.3.2 and A.3.3.3.3. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address the effects of primary coolant environment on fatigue life is adequate.

4.3.3.3.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that for effects of the primary coolant environment on fatigue life, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The applicant also has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.4 Nuclear Steam Supply System Transient Cycle Projection For 60-Year Operation

4.3.4.1 Summary of Technical Information in the Application

In LRA Section 4.3.4, the applicant summarized its evaluation of NSSS transient cycle projection for the 60-year period of extended operation. The applicant indicated the transients it used for calculating fatigue usage factors for the NSSS. For this set of cyclic design transients, the applicant compiled the number of operational cycles accrued to October 2003 and projected the number at the end of 60 years of operation to determine whether the results remain below the number of design-allowable cycles.

The applicant also stated that it had extrapolated the number of transients to be accumulated by 60 years of operation. The two options for extrapolating the number of transient cycles are:

(1) Develop histograms of each transient and, based on recent operating history (*i.e.*, the last ten years), project the cumulative number of operational cycles at 60 years

(2) Linearly extrapolate the cumulative number of operational cycles at 60 years

Because plant performance has improved with time, the first option typically results in a more accurate projection, the second, in a more conservative number of thermal cycles. Except for the plant heatup and cooldown, pressurizer cooldown, and reactor trip transients, the extrapolation for all transients used the second option. For the plant heatup and cooldown and for pressurizer cooldown, the projection of cycles used the first option. The applicant also chose the first option for the reactor trip transients but biased the extrapolation with additional reactor trips as the unit approaches end of life (EOL). Accrued operational cycles based on initial operations for Unit 1 of 1975 and Unit 2 of 1986 use a current plant life as of October 2003; therefore, the operating lifetimes for the evaluations were 28 and 17 years for Unit 1 and Unit 2, respectively. LRA Table 4.3-2 presents the results of the transient cycle extrapolation.

4.3.4.2 Staff Evaluation

The staff reviewed LRA Section 4.3.4, pursuant to 10 CFR 54.21(c)(1).

In LRA Section 4.3.4, the applicant states that histograms were developed based on the last ten years in order to perform an extrapolation for the number of accumulated transients in 60 years of operation for plant heatup and cooldown, and pressurizer cooldown. In RAI 4.3-16, dated

May 28, 2008, the staff requested that the applicant provide the histograms that were developed and the method used by the applicant to extrapolate these cycles to 60 years of operation.

In its response to RAI 4.3-16, dated July 11, 2008, the applicant provided the staff with the histograms for the Unit 1 heatup, cooldown and reactor trip projection. The applicant also provided the methodology that it used to extrapolate the projection to 60 years for these transients. The applicant explained that the histograms incorporated the Unit 1 heatup, cooldown and reactor trip transient cycles accrued through May 1, 2007 and are all subject to bias with additional cycles as Unit 1 approaches the EOL (60 years of operation). The staff noted that since these transients are expected to approach or exceed the number of design cycles during the period of extended operation, the applicant's Metal Fatigue of Reactor Coolant Pressure Boundary Program is required to monitor these transients and to initiate corrective actions if the triggering point is reached. The staff further noted that in the response, the applicant did not provide the histogram for the pressurizer cooldown. Therefore, on August 28, 2008, the staff held a teleconference with the applicant, during which time the applicant explained that the transient "pressurizer cooldown" is not independently tracked; and, therefore a histogram does not exist. By letter dated October 2, 2008, the applicant amended the LRA to remove the reference to the pressurizer cooldown transient since it is not applicable to Unit 1 and Unit 2.

Based on its review, the staff finds the applicant's response to RAI 4.3-16 acceptable because (1) the applicant provided the applicable histograms that were requested, which conservatively biased additional cycles of each transient as Unit 1 approaches the EOL (60 years of operation); (2) the applicant will monitor these transients as part of its Metal Fatigue of Reactor Coolant Pressure Boundary Program in accordance with 10 CFR 54.21(c)(1)(iii); and (3) that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. Therefore, the staff's concern described in RAI 4.3-16 is resolved.
In LRA Table 4.3-2, the staff noted that the 60-year projected operational cycle for operating-basis earthquakes (OBEs) is not provided. In RAI 4.3-11, dated May 28, 2008, the staff requested that the applicant confirm the number of OBE occurrences or stress cycles it will consider in the 60-year EAF evaluation.

In its response to RAI 4.3-11, dated July 11, 2008, the applicant stated that based on its response to RAI 4.3-3, the analyses for environmentally assisted fatigue is still on going. The applicant further stated that for those analyses that have already been completed, a minimum of 50 OBE cycles have been incorporated. However, for those analyses that have not yet been completed, the applicant also intends to use a minimum of 50 cycles of OBE. If fewer cycles are used, the applicant will report this change to the staff, along with the results of the remaining analyses. The staff confirmed that 50 cycles was specified in the final safety analysis report and the applicant's use of at least 50 cycles of OBE transients is acceptable. The applicant committed (Regulatory Commitment No. 1) to perform the reanalysis for the applicable NUREG/CR-6260 locations and to submit the results to the staff, along with a summary of how the analysis was performed, no later than October 15, 2008. The applicant also committed to the use of a minimum of 50 cycles of the OBE transient and if needed, will report the use of less than 50 cycles along with the results. However, the staff noted that using less than 50 cycles of the OBE transient would not be consistent with the CLB. The applicant amended the LRA by letter dated October 2, 2008, and clarified that for the design fatigue analysis for the NUREG/CR-6260 locations utilized a minimum of 50 cycles of OBE (five events with ten cycles each). The staff confirmed that the applicant amended its response to RAI 4.3-11 and has withdrawn Regulatory Commitment No. 1, as described in SER Section 4.3.3.3.2.

Based on its review, the staff finds that the applicant's response to RAI 4.3-11 is acceptable because the applicant has provided the requested information regarding the number of OBE transients that will be incorporated in the environmental assisted fatigue analyses (a minimum of 50 cycles of OBE, which is consistent with the CLB) and has committed to perform the reanalysis and has provided the results and method of analysis to the staff for the applicable NUREG/CR-6260 locations by letter dated October 2, 2008. Therefore, the staff's concern described in RAI 4.3-11 is resolved.

During the audit, the staff noted that the basis document WCAP-16173-P, Table 6-1, "Beaver Valley Units 1 and 2 Design Basis Transient Evaluation for License Renewal," March 2004, including Errata dated August 11, 2004 shows that the design cycles of OBE is 50 for several NSSS components of Unit 1, including the RV and pressurizer. The staff noted that annotation (d) of the LRA Table 4.3-2 states that the number of the design cycles for the OBE is 400 cycles for NSSS equipment and 50 cycles for the piping. In RAI 4.3-14, dated May 28, 2008, the staff requested that the applicant explain the discrepancy between LRA Table 4.3-2 and WCAP-16173-P, Table 6-1 and how the design cycles for the OBE will be considered in the CUF evaluation.

In its response to RAI 4.3-14, dated July 11, 2008, the applicant stated that the design cycles for the OBE listed in LRA Table 4.3-2 were taken from the UFSAR Table 4.1-10, Revision 24, for Unit 1. The applicant noted that WCAP-16173-P, Table 6-1 shows that the Unit 1 RV, pressurizer and steam generators were designed for 50 cycles of the OBE. The staff noted that the original steam generators were designed to 50 cycles of the OBE; however, the applicant has confirmed that the replacement steam generators have been designed for 400 cycles of the OBE. The applicant further noted that the information provided for the RV and pressurizer has been confirmed, and each is designed for 50 cycles of the OBE; and, the LRA has been amended to reflect this change. The staff noted that the applicant will address the error in UFSAR Table 4.1-10 for the Unit 1 under its corrective action program, which is subject to the 10 CFR 50.59 process. As described in the staff's evaluation of RAI 4.3-11, the applicant committed (Regulatory Commitment No. 1) to use a minimum of 50 cycles of the OBE when performing the CUF analyses for the NUREG/CR-6260 locations and to provide the results to the staff, along with a summary of how the analyses was performed, no later than October 15, 2008.

Based on its review, the staff finds the applicant's response to RAI 4.3-14 acceptable because the applicant will correct the discrepancy in the UFSAR for Unit 1 as part of its corrective action program, subject to a 10 CFR 50.59 review and has committed to perform the reanalysis for the applicable NUREG/CR-6260 locations and to provide to the staff, the results and method of analysis. Therefore, the staff's concern described in RAI 4.3-14 is resolved.

4.3.4.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the NSSS transient cycle projection for 60-year operation in LRA Sections A.2.3 and A.3.3. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address NSSS transient cycle projection for 60-year operation is adequate.

4.3.4.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. The staff further concludes, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.4 Environmental Qualification of Electric Equipment

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 loss-of-coolant accidents (LOCAs) or high-energy line breaks (HELBs). EQ equipment comprises safety-related and Q-list equipment; nonsafety-related equipment, the failure of which could prevent satisfactory accomplishment of any safety-related function; and, necessary post-accident monitoring equipment.

As required by 10 CFR 54.21(c)(1), the applicant must provide a list of EQ TLAAs in the LRA. The applicant shall demonstrate that for each type of EQ equipment, one of the following is true: (1) the analyses remain valid for the period of extended operation, (2) the analyses have been projected to the end of the period of extended operation, or (3) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

4.4.1 Summary of Technical Information in the Application

In LRA Section 4.4, the applicant summarized its evaluation of EQ of electrical equipment for the period of extended operation. The applicant's existing Environmental Qualification (EQ) of Electric Components Program manages component thermal, radiation and cyclical aging, as applicable, through the use of aging evaluations that are based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation.

The Environmental Qualification (EQ) of Electric Components Program ensures that these EQ components are maintained in accordance with their qualification bases. Aging evaluations for EQ components that specify a qualification of at least 40 years are TLAAs for license renewal.

4.4.2 Staff Evaluation

The staff reviewed LRA Section 4.4 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The staff reviewed LRA Section 4.4 and plant basis documents to determine whether the applicant provided adequate information to meet the requirements of 10 CFR 54.21(c)(1). For the electrical equipments identified in the EQ master list, the applicant used 10 CFR 54.21(c)(1)(iii) in its TLAA evaluation to demonstrate that the aging effects of EQ equipment will be adequately managed during the period of extended operation. The staff reviewed the EQ program to 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 of 10 CFR 50.49.

The staff conducted an audit of the information provided in LRA Section B 2.14 and the program basis documents. Based on its audit, the staff finds that the EQ program, which the applicant claimed to be consistent with GALL AMP X.E1, "Environment Qualification of Electrical Components," is consistent with EQ program in the GALL report. Therefore, the staff finds that the EQ program is capable of programmatically managing the qualified life of components within the scope of the program for license renewal. The continued implementation of the EQ program provides reasonable assurance that the aging effects will be managed and that components within the scope of the EQ program will continue to perform their intended functions for the period of extended operation.

4.4.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of EQ of electrical equipment in LRA Section A.1.14. The UFSAR supplement is inconsistent with those in SRP-LR Table 4.4.2 in that it does not contain reanalysis attributes. Reanalysis addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met, and the period of time prior to the end of qualified life when the reanalysis will be completed. In RAI B.2.14-1, dated May15, 2008, the staff requested that the applicant provide the important attributes of reanalysis of an aging evaluation in the UFSAR and the time when the reanalysis will be completed or provide a justification why it is not necessary to include these attributes in the UFSAR supplement.

In its response to RAI B.2.14-1, dated June 17, 2008, the applicant revised LRA Section A.1.14, "Environmental Qualification (EQ) of Electrical Components Program," to add additional details regarding the EQ component reanalysis attributes as detailed in GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components."

Based on its review of the UFSAR supplement, the staff concludes that the applicant's response to RAI B.2.14-1 and the summary description of its actions to address EQ of electrical equipment is adequate. Therefore, the staff's concern described in RAI B.2.14-1 is resolved.

4.4.4 Conclusion

Based on its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that for EQ of electrical equipment, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.5 Concrete Containment Tendon Prestress

4.5.1 Summary of Technical Information in the Application

In LRA Section 4.5, a summary of evaluation of concrete containment tendon prestress for the period of extended operation is not applicable since Unit 1 and Unit 2 have no pre-stressed tendons in the containment building.

4.5.2 Staff Evaluation

The containment building has no prestressed tendons; therefore, the staff finds this TLAA is not required.

4.5.3 UFSAR Supplement

The staff concludes that no UFSAR supplement is required because the containment building has no pre-stressed tendons.

4.5.4 Conclusion

Based on its review, as discussed above, the staff concludes this TLAA is not required.

4.6 Containment Liner Plate, Metal Containment, and Penetrations Fatigue

4.6.1 Containment Liner Fatigue

In LRA Section 4.6.1, the applicant summarized the evaluation of containment liner fatigue for the period of extended operation. The function of the liner is to act as a gas tight membrane and no credit is taken for the liner's ability to resist primary bursting stresses. The applicant stated in the LRA that cyclic loads considered in the design of the liners for Units 1 and 2 include: (a) differential pressure cycling due to plant normal operation, namely startup and shutdown; (b) thermal cycling due to plant normal operation, namely startup and shutdown; and (c) stresses due to seismic cycling.

4.6.1.1 BVPS 1 Containment Liner

In LRA Section 4.6.1.1, the applicant stated that the Unit 1 containment liner stress analysis determines a fatigue usage factor based on specific design cyclic loads in accordance with ASME Code Section III, 1968 Edition, Paragraph N-415.2. In UFSAR Table 5.2-13 for Unit 1, the applicant noted 150 cycles of loading due to the differential pressure between operating and atmospheric pressure for a 60-year span, 600 cycles of loading due to thermal expansion resulting for a 60-year span, and 150 cycles of OBE for a 60-year span. The design limit includes 1000 cycles for operating pressure cycles, 4000 cycles for operating temperature variations, and 20 cycles for design basis earthquake. In the LRA, the applicant stated that the design cycles of the Unit 1 Containment liner bound the anticipated pressure and temperature cycles expected through the period of extended operation. The applicant further stated that the expected stresses resulting from the 60-year anticipated OBE cycles were determined to be bounded by those limits due to the analyzed design-basis earthquake cycles. Therefore, the Unit 1 containment liner fatigue TLAA has been dispositioned pursuant to 10 CFR 54.21(c)(1)(ii).

4.6.1.1.1 Staff Evaluation

The staff reviewed LRA Section 4.6.1, pursuant to 10 CFR 54.21(c)(1)(ii), to verify that the analyses have been projected to the end of the period of extended operation.

The staff's review of the SRP-LR Section 4.6.1 evaluation of the containment liner plates, metal containment, and penetrations fatigue analysis found that the applicant's code of record requires a fatigue analysis for the liner, from mechanical loadings in addition to thermal and anchor motion. For this reason, the staff reviewed the containment liner fatigue evaluation for the period of extended operation as required by 10 CFR 54.21(c). During its review, the staff reviewed UFSAR Table 5.2-13 for Unit 1 and some related onsite basis documents and found that both projected CUFs for 60 years. For pressure variation due to normal operations and temperature variation due to normal operations, CUFs are projected at 0.15. During a conference call held on October 8, 2008, the staff requested that the applicant address how the expected stresses resulting from the 60-year anticipated OBE cycles were bounded by those due to the analyzed design-basis earthquake cycles, since the design-basis earthquake cycles does not bound the 60-year anticipated OBE cycles. In the letter dated November 5, 2008, the applicant stated that the fatigue analysis determined the stress due to the combination of the thermal, normal operation and design-basis earthquake loadings. In determining the CUF, that combination was then considered as 4000 cycles of fluctuation from the operation condition (including design-basis earthquake) to the zero-stress state. The applicant further stated that the 60-year anticipated occurrence of 150 pressure cycles, 600 temperature cycles and 150 OBE cycles are bounded by the 4000 analyzed cycles. Therefore, the applicant concluded that no revision to the Unit 1 containment liner stress analysis was required and amended the LRA to change the TLAA disposition from 10 CFR 54.21(c)(1)(ii) to 10 CFR 54.21(c)(1)(i). The applicant also amended LRA Sections 4.6.1.1 and A.2.5.1 to reflect the change.

The staff reviewed supplement information and LRA amendment (Amendment No. 30) and finds that the applicant's assumption of 4000 combined cycles for normal operating, thermal, and design-basis earthquake loadings is conservative. The staff also confirms from the UFSAR for Unit 1 that expected stresses result from a combination of normal operating, thermal, and design-basis earthquake loadings. The staff determines that the 60-year anticipated occurrences of pressure cycles, temperature cycles and OBE cycles are bounded by the 4000 analyzed cycles and the projected CUF for 60 years is 0.225.

The staff reviewed the information presented in LRA Section 4.6.1.1 and finds that the applicant's containment liner stress analyses for Unit 1 follows the guidance of SRP-LR

Section 4.6.1. Therefore, the staff concludes that the existing analyses of fatigue for the Unit 1 containment liner will remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.6.1.2 BVPS 2 Containment Liner

In LRA Section 4.6.1.2, the applicant stated that as a design guideline, the Unit 2 containment liner was designed in accordance with the ASME Code Section III, 1971 Edition, using stress limits and fatigue criteria based on the rules for ASME Code Classes MC and 1. The applicant further stated that a detailed analysis for fatigue is not required, if six specific requirements are met as defined in ASME Code Section III, NB-3222.4(d). In UFSAR Table 3.8-9 for Unit 2, the applicant has indicated 150 cycles of loading due to the differential pressure between operating and atmospheric pressure for a 60-year span, 600 cycles of loading due to thermal expansion resulting for a 60-year span, and 150 cycles of OBE for a 60-year span.

4.6.1.2.1 Staff Evaluation

The staff reviewed LRA Section 4.6.1.2, pursuant to 10 CFR 54.21(c)(1)(ii), to verify that the analyses has been projected to the end of the period of extended operation.

The staff's review of the SRP-LR Section 4.6.1 evaluation of the containment liner plates, metal containment, and penetrations fatigue analysis found that the applicant's code of record requires a fatigue analysis for the liner, from mechanical loadings in addition to thermal and anchor motion. For this reason, the staff reviewed the containment liner fatigue evaluation for the period of extended operation as required by 10 CFR 54.21(c). During the review, the staff found that the stress limits and fatigue criteria of the Unit 2 containment liner follow the design guidelines in accordance with ASME Code Section III, 1971 Edition. The staff confirmed that the ASME Code Section III does not require a detailed fatigue analysis, if six specific requirements are met as defined in Subsection NB-3222.4(d). The staff also reviewed the Unit 2 UFSAR Table 3.8-9 and found that the design limit includes 1000 cycles for operating pressure cycles, 4000 cycles for operating temperature variations, and 20 cycles for safe shutdown earthquake. The staff reviewed the applicant's re-evaluation of the six fatigue exemption requirements, utilizing anticipated 60-year stress cycles, and determined that extended operation continues to satisfy the requirement for exemption from a detail fatigue analysis for cyclic operation. Therefore, the staff confirms that the design load cycles will not be reached by the anticipated 60-year load cycles.

The staff reviewed LRA Section 4.6.1.2 and the relevant references cited in the TLAA and finds that the applicant's containment liner stress analyses for Unit 2 follows the guidance of SRP-LR Section 4.6.1. Therefore, the staff concludes that the analyses of fatigue for the Unit 2 containment liner have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.6.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the Unit 1 containment liner fatigue in LRA Section A.2.5.1 (Amendment No. 30). In LRA Section A.3.5.1, the applicant also provided a UFSAR supplement summary description of its TLAA evaluation of the Unit 2 containment liner fatigue. Based on its review of the UFSAR supplements, the staff concludes that the summary description of the applicant’s actions to address the containment liner fatigue is adequate because the applicant’s summary descriptions conform to the staff’s guidance in SRP-LR Section 4.6, Table 4.6-1.

4.6.1.4 Conclusion

Based on its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii), that for the containment liner fatigue TLAA, the analyses of Unit 1 containment liner remain valid through the period of extended operation, and the analyses of Unit 2 containment liner has been projected to the end of the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.6.2 Containment Liner Corrosion Allowance

4.6.2.1 Summary of Technical Information in the Application

In LRA Section 4.6.2, the applicant summarized the evaluation of containment liner corrosion allowance for the period of extended operation. The containment buildings for Units 1 and 2 have a continuously welded carbon steel liner which acts as a leak tight membrane. All welded seams were originally covered with continuously welded leak test channels which were installed to facilitate leak testing of welds during liner erection. Some vent plugs in the containment floor liner test channels for Units 2 and 1 were found missing in 1990 and 1991, respectively. The missing test channel vent plugs allowed moisture and condensation inside the test channels, leading to minor corrosion of the liner. In the LRA, the applicant stated that the test channels were evaluated to demonstrate that the corrosion rates inside the test channels would not result in the liner failing to meet its minimum required thickness based on a 40-year corrosion period. The applicant stated that these corrosion rate analyses meet the requirements of 10 CFR 54.3 as a TLAA and must be evaluated for the period of extended operation.

The applicant further stated that the corrosion allowance for the containment floor liners has a fabrication thickness of 0.25 inches and a minimum required thickness of 0.125 inches (both units). Thus, the corrosion allowance is 0.125 inches (125 mils). The total estimated penetration due to corrosion of the inerted channel was estimated at 69.2 mils and 82.7 mils for 40 years of plan operation and 3 years of pre-operational exposure for Units 1 and 2, respectively. The projected 60-year corrosion penetration depths yield 77.0 mils and 90.5 mils for Units 1 and 2, respectively.

4.6.2.2 Staff Evaluation

The staff reviewed LRA Section 4.6.2, pursuant to 10 CFR 54.21(c)(1)(ii), to verify that the analyses have been projected to the end of the period of extended operation.

The SRP-LR Section 4.1, Table 4.1-2, states that metal corrosion allowance is a potential TLAA. For this reason, the staff reviewed the containment floor liner corrosion evaluation for the period of extended operation as required by 10 CFR 54.21(c). The staff reviewed the related onsite basis documents and found that the applicant had calculated in one of the documents a different corrosion allowance value of 88 mils, instead of 125 mils. In RAI 4.6.2-1, dated May 8, 2008, the staff requested that the applicant explain the discrepancy of the corrosion allowance for the liner floor plate.

In its response to RAI 4.6.2-1, dated June 16, 2008, the applicant stated that the corrosion allowance of 88 mils was based on corrosion rate information published by the General Electric Corporation. The applicant explained that the basis document reviewed by the staff was a report prepared in March 1991. This and earlier reports used the 88 mils corrosion allowance in the context that there is sufficient margin in the containment liner thickness to easily accommodate a corrosion of 88 mils. The applicant further stated that liner floor plate minimum wall thickness of 125 mils was established by design analysis calculations, which provide a corrosion allowance of 125 mils out of a 0.25 inch plate and is the CLB.

Based on its review, the staff finds the applicant's response to RAI 4.6.2-1 acceptable because the applicant has clarified the discrepancy of the corrosion allowance for the liner floor plate. The staff confirms that the applicant's projected 60-year corrosion penetration depths yield 77.0 mils or 62% of the corrosion allowance, and 90.5 mils or 72% of corrosion allowance for Units 1 and 2, respectively. The staff determines that the applicant's containment liner corrosion analyses for Units 1 and 2 have been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii). Therefore, the staff's concern described in RAI 4.6.2-1 is resolved.

4.6.2.3 UFSAR Supplement

The applicant provided UFSAR supplement summary descriptions of the TLAA evaluation of the containment linear corrosion allowance in LRA Sections A.2.5.2 and A.3.5.2. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address the containment linear corrosion allowance is adequate because the applicant's summary description conforms to the guidance found in SRP-LR Section 4.6, Table 4.6-1.

4.6.2.4 Conclusion

Based on its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that for the containment linear corrosion allowance TLAA, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.6.3 Containment Liner Penetration Fatigue

4.6.3.1. *BVPS 1 Containment Liner Penetration Fatigue*

4.6.3.1.1 Staff Evaluation

In LRA Section 4.6.3.1, the applicant summarized the Unit 1 containment liner penetration fatigue as follows:

> (1) Cold penetrations have the process pipe welded to a plate flange which is anchored to the containment concrete wall such that loads can be

transferred from the piping to the reinforced concrete. Hot penetrations (> 180°F) are designed with a sleeve and liner such that water-cooled cooling units and appropriate insulation can be located inside the annulus to maintain the concrete temperature within allowable levels. UFSAR Section 5.2.4.8, indicated that the evaluation of the penetration discontinuities was done using a computer program entitled SHELL-1, which analyzes axisymmetric thin shells of revolution under unsymmetrical loading. The applicant evaluated the temperature distribution at discontinuity areas exposed to operating conditions using finite difference or finite elements techniques. While ASME Code Section III was used as a guide in the selection of design stresses used in the analysis of these penetrations, no specific fatigue analysis was completed for the Unit 1 piping penetrations. Therefore, no TLAA is associated with the Unit 1 piping penetrations.

(2) The equipment hatch and integral emergency airlock are designed and analyzed in accordance with ASME Code Section III, Division 1, Subsection NE (Class MC). The applicant completed a fatigue exemption the equipment hatch in accordance with Subsection NB-3222(d). This exemption was based on assumed cycles for a 40-year life, namely, 10 pressurization events due to LOCA and 80 cycles of startup and shutdown. The applicant stated that it is highly unlikely that Unit 1 will reach 10 pressurization events due to LOCA during 60-years of operation. The assumption of 80 cycles of startup and shutdown is not bounding for 60 years of operation. The applicant performed a reanalysis using 240 startup and shutdown cycles that bounds the number of projected cycles for the period of extended operation. Therefore, the equipment hatch fatigue TLAA has been dispositioned in accordance with 10 CFR 54.21(c)(1)(ii).

(3) The applicant analyzed the personnel air lock pursuant to ASME Code Section III, Class B. However, no fatigue analysis was completed for this air lock. Therefore, no TLAA is associated with the personnel air lock.

(4) The applicant analyzed the fuel transfer tube pipe pursuant to ASME Section III, Division 1, Subsection NC. The analysis for the fuel transfer tube pipe uses a stress range reduction factor of 1.0 (<7,000 cycles). However, since the fuel transfer tube pipe experiences operational cycles only during refueling, the fuel transfer tube pipe essentially experiences no thermal cycles. The applicant concluded that the existing fuel transfer tube pipe stress analysis remains valid through the period of extended operation. Therefore, the fuel transfer tube pipe fatigue TLAA has been dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

(5) The applicant also analyzed the fuel transfer tube bellows pursuant to ASME Section III, Division 1, Subsection NC. The applicant stated that the bellows stress analysis was acceptable on the basis that the bellows

experienced displacements due to a design-basis earthquake (DBE). The analysis assumed 600 design. The applicant further stated that the occurrence of this number of DBE cycles is highly unlikely during the period of extended operation. The applicant concluded that the fuel transfer tube bellows stress analysis remains valid through the period of extended operation. Therefore, the fuel transfer tube bellows fatigue TLAAs have been dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

4.6.3.1.2 UFSAR Supplement

During the audit and review, the staff reviewed LRA Section 4.6.3.1, pursuant to 10 CFR 54.21 (c)(1)(i), to verify that the analyses will remain valid for the period of extended operation, and pursuant to 10 CFR 54.21(c)(1)(ii), to verify that the analyses have been projected to the end of the period of extended operation.

The staff reviewed SRP-LR Section 4.6.1 for the containment liner penetration fatigue analysis and found that the applicant's code of record requires a fatigue analysis for the containment liner penetration from mechanical loadings as well as thermal and anchor motion. For this reason and to comply with 10 CFR 54.21(c), the staff reviewed the containment liner penetration fatigue evaluation for the period of extended operation and found the following:

(1) The staff reviewed the Unit 1 UFSAR Section 5.2.4.8 and determined that the applicant had performed an evaluation using a finite difference or finite elements techniques. The staff found that the applicant had not completed a specific fatigue analysis for the Unit 1 piping penetrations; and, therefore, no TLAA is associated with the Unit 1 piping penetrations. The staff confirmed with the applicant that no TLAA was associated with the Unit 1 piping penetrations and personnel air lock.

(2) The staff reviewed the plant-specific analysis documents for the equipment hatch and found that the applicant performed a reanalysis using 240 startup and shutdown cycles for a projected CUF for 60 years of 0.33. Therefore, the analyses of fatigue for the Unit 1 containment liner have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

(3) The staff also found the applicant did not complete a fatigue analysis for the air lock. Therefore, no TLAA is associated with the Unit 1 personnel air lock.

(4) Since the Unit 1 fuel transfer tube pipe experiences operational cycles only during refueling, essentially no thermal cycles are experienced. However, the applicant's analysis uses a stress range reduction factor of 1.0 (< 7,000 cycles) pursuant to ASME Code Section III, Division 1, Subsection NC; therefore, the existing fuel transfer tube pipe stress analysis remains valid through the period of extended operation and, the Unit 1 fuel transfer tube pipe fatigue TLAA has been dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

(5) The staff also noted that the Unit 1 fuel transfer tube bellows were analyzed pursuant to ASME Section III, Division 1, Subsection NC to determine acceptability based on the bellows experiencing displacements due to a DBE. The assumed design cycles were 600. The occurrence of this number of DBE cycles is highly unlikely during the period of extended operation. Therefore, the Unit 1 fuel transfer tube bellows fatigue TLAA has been dispositioned in accordance with 10 CFR 54.21(c)(1)(i).

The staff concludes that the information presented in LRA Section 4.6.3.1 and the relevant references cited in the TLAA are acceptable and finds that they meet the requirements of SRP-LR Section 4.6.1. Therefore, the fatigue analyses of fatigue for the Unit 1 containment liner penetrations have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii).

4.6.3.1.3 Conclusion

Based on its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii), that for the containment liner penetration fatigue TLAA, the analyses correspondingly either remain valid through the period of extended operation or has been projected to the end of the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.6.3.*2 BVPS 1 Containment Penetration Bellows*

In LRA Section 4.6.3.2, the applicant summarized the Unit 1 containment penetration bellows and stated that the Unit 1 containment penetration bellows are part of the system evaluation boundary of the Unit 1 river water system. The piping and in-line components of the Unit 1 river water system are designed and analyzed in accordance with the ANSI B31.1 standard, which specifies evaluation of cyclic secondary stresses by applying stress range reduction factors against the allowable stress range. The assumed design limit is 7,000 thermal cycles. The staff noted that the Unit 1 recirculation system fatigue analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.6.3.2.1 Staff Evaluation

The staff reviewed LRA Section 4.6.3.2, pursuant to 10 CFR 54.21 (c)(1)(i), to verify that the analyses will remain valid for the period of extended operation.

The staff's review of the SRP-LR Section 4.6.1 evaluation of the containment liner penetration bellows analysis found that the applicant's code of record requires a fatigue analysis for the liner from mechanical loadings as well as thermal and anchor motion. For this reason, the staff reviewed the containment liner fatigue evaluation for the period of extended operation, as required by 10 CFR 54.21(c). During the review, the staff confirmed that the stress analysis of the Unit 1 containment penetration bellows follows the ANSI B31.1, 1967 Addition standard. The staff noted that the Unit 1 recirculation spray system normally is in standby operation and including any periodic tests, will experience significantly less than the 7,000 full temperature cycle limits for the period of extended operation.

Therefore, the Unit 1 containment liner penetration bellows TLAA analyses remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.6.3.2.2 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the Unit 1 containment liner penetration fatigue in LRA Section A.2.5.3. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address the containment liner penetration fatigue is adequate because the applicant's summary description conforms to the guidance found in SRP-LR Section 4.6, Table 4.6-1.

4.6.3.2.3 Conclusion

Based on its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i) that for the containment liner penetration bellows TLAA, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.6.3.3 BVPS 2 Containment Liner Penetration Fatigue

In LRA Section 4.6.3.3, the applicant summarized the Unit 2 Containment Liner Penetration Fatigue as follows:

(1) The applicant designed and analyzed the Unit 2 process piping penetrations in accordance with the ASME Code Section III, Division 1, 1971 Edition through the 1972 Winter Addenda, Subsection NC (Class 2), which complies with the process piping system requirements of which these penetrations are a part. The applicant further analyzed the penetrations in accordance with the more rigorous Subsection NE (Class MC) requirements. ASME Code Section III, Division 1, Class 2 requirements include a stress range reduction factor which accounts for an assumed number of thermal cycles. In addition, the applicant performed a fatigue exemption of the Class MC portion of the stress analysis in accordance with ASME Code Section III, Subsection NE-3322(d) and evaluated the validity of this assumption for 60 years of plant operation. The results of the evaluation indicate that the thermal cycle assumption is valid and bounding for 60 years of operation. Therefore, the applicant determined that the piping penetration fatigue analyses remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

(2) The applicant designed and analyzed the Unit 2 containment equipment hatch and integral emergency airlock in accordance with ASME Code Section III, Division 1, Subsection NE (Class MC), 1971

Edition through 1972 Winter Addenda. The applicant stated that a reanalysis, using projected 60-year startup and shutdown cycles, was performed for the period of extended operation to confirm the fatigue exemption described in ASME Code, Subsection NB-3222(d), in accordance with 10 CFR 54.21(c)(1)(ii).

(3) The applicant analyzed the personnel air lock in accordance with ASME Code Section III, Division 1, Subsection NE (Class MC) but did not complete a fatigue analysis for this air lock. Therefore, no TLAA is associated with the Unit 2 personnel air lock.

(4) The applicant designed and analyzed the Unit 2 fuel transfer tube pipe in accordance with ASME Code Section III, Class 2 (Subsection NC). The applicant stated that the design cycles of the Unit 2 fuel transfer tube pipe, relative to the stress range reduction factor of 1.0 (<7,000 cycles), bound the anticipated 60-year Unit 2 refueling cycles expected through the period of operation. The applicant determined that the existing fuel transfer tube pipe stress analysis remains valid through the period of extended operation, and dispositioned the Unit 2 fuel transfer tube pipe fatigue TLAA in accordance with 10 CFR 54.21(c)(1)(i).

(5) The applicant designed and analyzed the Unit 2 fuel transfer tube bellows in accordance with ASME Section III, Class MC. The applicant's bellows stress analysis determined acceptability based on the bellows experiencing displacements due to a design basis earthquake. The applicant assumed 600 design cycles in its analysis. The applicant determined that the existing fuel transfer tube bellows stress report remains valid through the period of extended operation, and dispositioned the Unit 2 fuel transfer tube bellows fatigue TLAAs in accordance with 10 CFR 54.21(c)(1)(i).

4.6.3.3.1 Staff Evaluation

During its review, the staff reviewed LRA Section 4.6.3.3, pursuant to 10 CFR 54.21 (c)(1)(i), to verify that the analyses will remain valid for the period of extended operation, and pursuant to 10 CFR 54.21 (c)(1)(ii), to verify that the analyses have been projected to the end of the period of extended operation.

The staff review of the SRP-LR Section 4.6.1 evaluation of the containment liner penetration fatigue analysis found that the applicant's code of record requires a fatigue analysis for the liner from mechanical loadings as well as thermal and anchor motion. For this reason, the staff reviewed the containment liner fatigue evaluation for the period of extended operation, as required by 10 CFR 54.21(c) and determined the following:

(1) The staff noted that as a design guideline, the stress limits and fatigue criteria of the Unit 2 process piping penetrations follow the ASME Code Section III, Division 1, Subsection NC (Class 2). The staff verified that

the applicant has further analyzed the penetrations in accordance with the more rigorous Subsection NE (Class MC) requirements which allow an exemption of a detailed fatigue analysis, if specific requirements are met as defined in ASME Code Section III, NB-3222(d). The staff reviewed the applicant's existing evaluation of the fatigue exemption requirements based on the LRA and plant-specific analysis documents, and confirmed that the applicant's assumed full-temperature design cycles bound the anticipated 60-year significant thermal cycles of Unit 2 process piping penetrations, including: (a) unsleeved penetrations; (b) sleeved piping penetrations; and (c) multiple piping penetrations. Therefore, the staff determines that the applicant's existing Unit 2 process piping penetration fatigue analyses will remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

(2) The staff confirmed that the applicant has designed and analyzed the Unit 2 containment equipment hatch and integral emergency airlock in accordance with ASME Code Section III, Division 1, Subsection NE (Class MC), which exempts a detailed analysis for fatigue, if specific requirements are met in accordance with ASME Code Section III, NB-3222(d). The staff noted that the applicant's assumption of 10 pressurization events due LOCA for 40-year life is bounding for 60 years of operation. The staff also reviewed the applicant's plant-specific analysis documents for the equipment hatch and found that a reanalysis was performed using 240 startup and shutdown cycles that bounds the number of projected cycles for the period of extended operation, instead of the its assumed 80 cycles for a 40-year life. Therefore, the staff determines that the applicant's the analyses of fatigue for the Unit 2 containment equipment hatch have been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

(3) The staff also confirmed that no fatigue analysis was required for the air lock. Therefore, the staff determines that no TLAA is associated with the Unit 2 personnel air lock.

(4) The staff agreed with the applicant that the design cycles of the Unit 2 fuel transfer tube pipe in terms of stress range reduction factor of 1.0 (<7,000 cycles) bound the anticipated 60-year Unit 2 refueling cycles expected through the period of operation, because the Unit 2 fuel transfer tube pipe experiences operational cycles only during refueling, and essentially experiences no thermal cycles. Therefore, the staff determines that the applicant's existing fuel transfer tube pipe stress analysis remains valid through the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

(5) The staff noted that as a design guideline, the applicant's stress analysis of the Unit 2 fuel transfer tube bellows follows ASME Code Section III, Class MC requirements to determine acceptability based on the bellows experiencing displacements due to a design-basis earthquake. The applicant assumed 600 cycles for design-basis earthquake. The staff confirms that the assumed number of design-basis earthquake cycles is

unlikely to occur during the period of extended operation. For that reason, the staff agrees that the assumed 600 design-basis earthquake bounds the anticipated 60-year Unit 2 OBE cycles expected through the period of operation. Therefore, the staff determines that the applicant's existing fuel transfer tube bellows stress report remains valid through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The staff concludes that the information presented in LRA Section 4.6.3.3 and the relevant references cited in the TLAA follows the guidance of SRP-LR Section 4.6.1. Therefore, the applicant's analyses of fatigue for the Unit 2 containment liner penetrations either remain valid through the period of extended operation or have been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii), respectively.

4.6.3.3.2 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the Unit 2 containment linear penetration fatigue in LRA Section A.3.5.3. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address the containment linear penetration fatigue is adequate because the applicant's summary description conforms to the guidance found in SRP-LR Section 4.6, Table 4.6-1.

4.6.3.3.3 Conclusion

Based on its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21 (c)(1)(i) and 10 CFR 54.21(c)(1)(ii), that for the containment linear penetration fatigue TLAA, the analyses correspondingly either remain valid through the period of extended operation or have been projected to the end of the period of extended operation. The staff also concludes that the FSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7 Other Time-Limited Aging Analyses

In LRA Section 4.7, the applicant summarized its evaluations of the following plant-specific TLAAs:

- piping subsurface indications (Unit 1 only)
- reactor vessel underclad cracking (Unit 1 only)
- leak-before-break
- high-energy line break postulation
- settlement of structures (Unit 2 only)
- crane load cycles

4.7.1 Piping Subsurface Indications (Unit 1 Only)

4.7.1.1 Summary of Technical Information in the Application

During the inservice inspection (ISI) for Unit 1 at RFO 11 (March to May 1996), the applicant detected an indication in a weld which joined an elbow and a Section of straight pipe on the

RCS Loop C cold leg that exceeded the acceptance criteria of ASME Code, Section XI, Subsection IWB-3500. The applicant noted that the composition of the Section of straight pipe is Class 1 cast austenitic stainless steel (CASS).

The applicant performed a flaw evaluation pursuant to ASME Code, Section XI, Subsection IWB3600, with support from Appendix C; and, concluded that the postulated flaw met the Code requirements with significant margins of safety to the end of the service lifetime. By letter dated May 1, 1996, the staff approved the applicant's flaw evaluation. The staff further determined that this evaluation is a TLAA because the two parameters used in the evaluation, namely, thermal aging and fatigue transient cycles, are based on the service life of the piping (*i.e.,* time-dependent).

Thermal aging of CASS material continues until it reaches the saturation or fully-aged point. The limiting fracture toughness properties are those of the straight pipe, which has relatively high ferrite content. Therefore, the applicant used the fully-aged (saturated) fracture toughness properties of the straight pipe in its flaw evaluation. The applicant stated that because fully-aged stainless steel material properties were used, its flaw evaluation has no material property time-dependency requiring further TLAA evaluation for license renewal.

The applicant postulated an initial flaw and calculated the crack growth based on imposed loading transients. The transient cycles assumed in the flaw evaluation are conservative compared to the original design cycles. In LRA Table 4.3-2, the applicant showed the original design-basis transients, including RCS design cycles, along with the projected operational cycles that it anticipates will occur for 60 years of plant life. Based on projected operational cycles to 60 years, the applicant has determined that the design cycles are bounding for the period of extended operation.

The applicant stated that because the flaw growth evaluation remains valid for 60 years based on the 60-year projected operational cycles, the Metal Fatigue of Reactor Coolant Pressure Boundary Program will be used to validate the cycles assumed in the flaw evaluation.

4.7.1.2 Staff Evaluation

The staff reviewed LRA Section 4.7.1 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses have been projected to the end of the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In LRA Section 4.7.1, the applicant stated that an indication was identified on the RCS loop C cold leg between an elbow and a Section of straight pipe. The staff determined that additional information was required to complete the its review.

In RAI 4.7.1-1, dated April 1, 2008, the staff requested that the applicant (a) explain the inspection history and results of the indication; (b) confirm the future inspection frequency of the indication; (c) clarify the exact location of the subject indication (*e.g.*, in the weld that joins the elbow and pipe, on the elbow, or on the pipe), and (d) explain the degradation mechanism of the indication.

In its response to RAI 4.7.1-1, dated June 2, 2008, the applicant:

- explained in part (a) that a flaw indication for weld DLW-LOOP3-7-S-02 was identified during a Unit 1 ISI examination performed in 1996. The applicant provided the dimensions for a flaw that would bound the indications found during the examination. The applicant indicated that since the flaw indication exceeded the ASME Code IWB-3500, an analysis was performed and approved by the staff to ensure that flaw met the applicable requirement with significant margins of safety to the end of service lifetime.
- confirmed in part (b) that a relief request was submitted to the staff. The staff substantially granted the applicant's relief request, which the applicant noted that the subject weld is not scheduled for future examinations.
- clarified in part (c) that the weld is the first circumferential weld after the RV nozzle-to-safe-end weld on the RCS C loop cold leg (the other end of the elbow is welded to the Reactor Vessel safe-end).
- explained in part (d) that the degradation is not caused by stress-corrosion cracking based on the conclusion reached in the flaw analysis for the subject weld.

The staff reviewed the applicant's responses and the accompanying references for the responses and confirms that the staff has approved both the evaluation of flaw indication in the reactor coolant system (RCS) cold leg pipe weld and the relief request for an alternative risked-informed ISI.

Based on its review, the staff finds the applicant's response to RAI 4.7.1-1 acceptable because the applicant has adequately (a) explained the inspection history and results of the indication; (b) confirmed the future inspection frequency of the indication; (c) clarified the exact location of the subject indication (*e.g.*, in the weld that joins the elbow and pipe, on the elbow, or on the pipe), and (d) discussed the degradation mechanism of the indication. Therefore, the staff's concern described in RAI 4.7.1-1 is resolved.

In LRA Section 4.7.1, the applicant indicated that a flaw occurred between an elbow and a Section of straight pipe, which is made up Class 1 CASS piping. The staff was unclear as to the material specification and the indication characterization, and determined that additional information was required to complete the evaluation.

In RAI 4.7.1-2, dated April 1, 2008, the staff requested that the applicant (a) confirm that the elbow is made of CASS; (b) verify the material specification of the weld that joins the elbow and the pipe; (c) describe the indication size and characterization, and (d) justify the reliability and accuracy of the detection and characterization of the subject indication, since ultrasonic testing (UT) of CASS material cannot be performed to meet the requirements of ASME Code, Section XI, Appendix VIII.

In its response to RAI 4.7.1-2, dated June 2, 2008, the applicant:

- confirmed in part (a) that elbow was fabricated from Grade CF8M CASS.
- verified in part (b) that the weld filler material is TP 308 stainless steel. The applicant also noted that the weld was made using a tungsten inert gas weld process for the root passes.

- described in part (c) that ISI examinations revealed the presence of four inside diameter (ID) indications. In addition, the applicant stated that the four indications were considered bounded by a single composite flaw, for which the applicant also provided dimensions.
- justified in part (d) how each of the three examinations was performed. In addition, the applicant provided the reference for a SER in which the staff confirmed the presence of this flaw indication during an independent inspection on April 25, 1996.

The staff reviewed the applicant's response as well as the abovementioned SER. The staff notes that given the difficult conditions for accurate interpretation of the indication from UT, the applicant selected a flaw size that bounded all four indications. This approach, the staff notes, provided a conservative application of the flaw shape requirements of the ASME Code Section XI, Appendix C. In addition, the staff confirms that the abovementioned SER provided the dimension of the flaw based on staff inspection and concludes that it is comparable to that selected by the applicant.

Based on its review, the staff finds the applicant’s response to RAI 4.7.1-2 acceptable because the applicant has adequately: (a) confirmed that the elbow is made of CASS; (b) verified the material specification of the weld that joins the elbow and the pipe; (c) described the indication size and characterization, and (d) justified the reliability and accuracy of the detection and characterization of the subject indication. Therefore, the staff’s concern described in RAI 4.7.1-2 is resolved.

In LRA Section 4.7.1, the applicant indicated that the fully aged fracture toughness properties of the CASS straight pipe were used in the flaw evaluation. However, it was not clear to the staff whether the CASS piping has more limiting material properties compared to the subject weld. The staff determined that additional information was required to complete its review.
In RAI 4.7.1-3, dated April 1,, 2008, the staff requested that the applicant confirm that the fracture toughness properties of the CASS piping are more limiting than the fracture toughness of the weld at the 60 years.

In its response to RAI 4.7.1-3, dated June 2, 2008, the applicant provided the fracture toughness values for the full service life of elbow, weld, and piping. The applicant noted that these values were used in the flaw analysis submitted to and approved by the staff. The staff confirms that the fracture toughness value for the piping is the most limiting and; therefore, appropriately used by the applicant in the flaw analysis.

Based on its review, the staff finds the applicant’s response to RAI 4.7.1-3 acceptable because the applicant has confirmed that the fracture toughness properties of the CASS piping are more limiting than the fracture toughness of the weld at the 60 years. Therefore, the staff’s concern described in RAI 4.7.1-3 is resolved.

In LRA Section 4.7.1, the applicant stated that the flaw evaluation includes the postulation of an initial flaw and the growth of that flaw based on imposed loading transients. However, the applicant did not include any information on the initial flaw size, the flaw growth rate, as well as loading transients. The staff was unable to conclude that flaw size will be within applicable limits at the end of the 60 years, and required additional information to complete its review.

In RAI 4.7.1-4, dated April 1, 2008, the staff requested that the applicant (a) explain the initial flaw size assumed in the analysis; (b) explain the flaw growth rate used and associated references; and (c) verify whether the operating cycles used in flaw evaluation performed in 1996 exceed the projected operational cycles at the end of 60 years.

In its response to RAI 4.7.1-4, dated June 2, 2008, the applicant:

- explained in part (a) that the initial flaw size assumed in the flaw analysis included flaw depth, length, thickness, depth parameter, and shape parameter.
- explained in part (b) that relevant data was used for austenitic stainless steels in a PWR water environment in an article from the Journal of Pressure Vessel Technology. In addition, the applicant stated that it used the appropriate crack growth rate equation. The staff notes that the above information was submitted by the applicant as part of flaw analysis. The staff subsequently approved the flaw analysis and documented its evaluation dated May 1, 1996. The staff verified in part (c) that the transients used in the flaw analysis are the design transients contained in the equipment specification. In addition, the applicant stated that Units 1 and 2 were designed to a slightly different set of transients than those used in the flaw analysis, and that these transient were considered to be conservative relative to the original design transients.

The staff reviewed the list of transients along with their cycle numbers considered in the flaw analysis and compared them with the Unit 1 original transients in LRA Table 4.3-2. The staff agreed with the applicant's claim that the flaw analysis transients were conservative relative to the original design transients. The staff notes that none of the original transients exceeded their design cycles at the end of 60 years, and concluded that the transients considered by the applicant in the flaw analysis will not exceed its design cycles.

Based on its review, the staff finds the applicant’s response to RAI 4.7.1-4 acceptable because the applicant has (a) adequately explained the initial flaw size assumed in the analysis; (b) adequately explained the flaw growth rate used and associated references; and (c) verified that the operating cycles used in flaw evaluation performed in 1996 do not exceed the projected operational cycles at the end of 60 years. Therefore, the staff’s concern described in RAI 4.7.1-4 is resolved.

In LRA Section 4.7.1, the applicant described a flaw indication identified on the RCS loop C cold leg between an elbow and a Section of straight pipe. The staff was unclear whether additional flaw indications existed at Units 1 and 2, and required additional information to complete its review.

In RAI 4.7.1-5, dated April 1,, 2008, the staff requested that the applicant: (a) identify all Class 1 components that contain indications or flaws that have remained in service at Units 1 and 2; (b) briefly explain the flaw evaluations performed for the affected components in accordance with the ASME Code, Section XI; (c) discuss how the indications or flaws were accepted and reference the appropriate ASME Code requirements; (d) provide indication and/or flaw characterization; and (e) discuss the analyses performed to accept the degraded components for the extended period of operation.

In its response to RAI 4.7.1-5, dated June 2, 2008, the applicant stated that LRA Section 4.7.1 only documents reportable flaws left-in-service with acceptance provided through analytical evaluations. The applicant also described its flaw evaluation process, and referenced ASME Code Section XI, IWB-3640 as the code used in the evaluation process. In addition, the applicant indicated that acceptance standards provided in ASME Code Section XI, Subsections IWB, IWC, or IWD were used to determine whether a flaw is reportable.

Based on its review, the staff finds the applicant's response to RAI 4.7.5-1 acceptable because the applicant has verified that its evaluation and characterization conforms to ASME Code Section XI. Therefore, the staff's concern described in RAI 4.7.5-1 is resolved.

In LRA Section 4.7.1, the applicant referenced an NRC safety evaluation for the indication on the RCS loop C cold leg. The staff determined that additional information was required to complete its review.

In RAI 4.7.1-6, dated April 1, 2008, the staff requested that the applicant verify the dates of the SER.

In its response to RAI 4.7.1-6, dated June 2, 2008, the applicant verified that the date contained in the LRA is correct. In addition, the applicant notified the staff that it had discovered that the subject flaw evaluation was not updated using revised loading conditions derived from the extended power uprate and steam generator replacement projects. Also, the applicant noted that it had performed an assessment for the indication confirming that the evaluation would remain acceptable for 60 years. The applicant indicated that for the assessment, it used the applicable thermal transients reflecting EPU conditions; latest piping reaction loads reflecting EPU conditions, including the replacement steam replacements; and thermal aging and/or fracture toughness pursuant to NUREG/CR-4513, Revision 1.

Based on its review, the staff finds the applicant's response to RAI 4.7.1-6 acceptable because the applicant has appropriately updated its flaw evaluation to reflect the current plant conditions. Therefore, the staff's concern described in RAI 4.7.1-6 is resolved.

Based on the above review of the applicant's response to the staff's RAI question, the staff's detailed evaluation is discussed below:

In LRA Section 4.7.1, the applicant stated that it detected indications in weld DLW-LOOP3-7-S-02, the first circumferential weld after the RV nozzle-to-safe-end weld on the RCS C loop cold leg (the other end of the RV nozzle-to-safe-end is welded to an elbow). The applicant verified that the elbow was fabricated of Grade CF8M CASS and Weld DLW-LOOP3-7-S-02 was fabricated with TP 308 stainless steel. The applicant further stated that the stainless steel weld was made using a tungsten inert gas welding process for the root pass and the remaining weld passes were made using a submerged arc welding process. The applicant noted that the TLAA concerns are thermal aging of the cast material and fatigue crack growth analyses because these two issues are time-dependent.

The applicant performed three separate UT examinations of the subject weld on March 26, March 27, and March 29, 1996, respectively. The applicant also conducted a follow-up examination on the inside surface of the pipe using a driver-pickup eddy current probe to verify that the indications were not connected to the inside surface of the pipe. Examination revealed the presence of four indications grouped in a band ranging from 4 inches to 14 inches below top dead center in the 9 o'clock to 12 o'clock quadrant looking toward the vessel.

The applicant did not report Individual depths; however, the applicant stated in its April 23, 1996 flaw evaluation report to the staff that the four indications were considered bounded by a single composite flaw. The composite flaw's depth and length were 0.68 inches and 10 inches, respectively and the pipe wall thickness was 2.66 inches. Even though examinations confirmed that the indications were not connected to the pipe surface, the fracture mechanics analysis conservatively assumed the indication to be surface-breaking.

Because the subject flaw exceeded the ASME Code, Section XI, Subsection IWB-3500 acceptance criteria, the applicant performed a flaw evaluation to ensure that this indication would remain within ASME Code, Section XI, Appendix C evaluation acceptance standards. The applicant's analysis concluded that the flaw met the applicable requirements, with significant margins of safety to the end of the service life. In its safety evaluation dated May 1, 1996, the staff concluded that the reported flaw was acceptable for continued service until the end of the service life, provided the weld was reexamined during each of the next three ISI periods. In addition, the staff confirmed the presence of this flaw indication during an independent inspection on April 25, 1996. The details of its inspection are documented in the staff's Integrated Inspection Reports 50-334/96-04 and 50-412/96-04.

As required by the ASME Code, Section XI, the applicant performed successive examinations of the subject weld for the first two ISI periods (first and second periods of the third ISI Interval) and the results indicated that no measurable growth was observed since the initial detection. The third period examination should have been completed during RFO 17 (February 13 to April 19, 2006) or RFO 18 (September 24 to October 24, 2007) for Unit 1. However, the applicant inadvertently removed this examination requirement from the ISI third Interval 10-year ISI Plan for Unit 1. Upon discovering the deficiency, the applicant addressed the missing examination under the FENOC Corrective Action Program and documented its remedies in CR 08-38344. In this report, the applicant rectified the missing examination by requiring that the missed UT examination be performed in a forced outage by March 31, 2009, to comply with the 1-year period extension requirement of ASME Code, Section XI. The applicant stated that it may extend the UT examination to RFO 1R19 (April 2009) and may submit a relief request, should the examination extend beyond March 31, 2009 (*i.e.*, in the April 2009 RFO). The staff finds that the applicant has scheduled the missing UT examination and, therefore, this issue is resolved.

In a letter dated April 9, 2004, the staff approved a relief request from the applicant to use an alternative risk-Informed ISI program for the ASME Code Class 1 and 2 piping welds at Unit 1 (for the third 10-year ISI interval) and Unit 2 (for the second 10-year ISI interval). Under the staff-approved alternative risk-informed ISI program, the subject weld is not scheduled for future examinations. As for the degradation mechanism that may have caused the indication, the applicant stated that the piping is not susceptible to stress-corrosion cracking (SCC) based on the conclusions of its flaw analysis for weld DLW-LOOP3-7-S-02. The potential for SCC is minimized by assuring that materials selections are compatible with the plant operating parameters and that a corrosive environment is not present. The applicant stated that since high residual stresses, materials susceptibility, and a corrosive environment all have to be present in order to experience SCC, the materials specifications coupled with the absence of a corrosive environment assures that SCC is not a degradation mechanism for this piping. The staff noted that the subject weld is made of stainless steel and the pipe is made of CASS. Based on the operating experience of PWRs, the likelihood of both of these metals being susceptible to SCC is small.

The staff noted that in the applicant's flaw evaluation, the applicant used the fully-aged fracture toughness properties of the CASS straight pipe in lieu of the weld. The flaw is located in weld DLW-LOOP3-7-S-02, not in the pipe; therefore, the weld material properties should be used in the flaw evaluation. The applicant clarified that the fracture toughness value of the piping is lower than that of the elbow and weld and, therefore, is limiting. The staff finds that even though the indications are located in the weld, using material properties of the piping to analyze the crack growth of the indication is more conservative than using the material properties of the subject weld. The staff noted that the fracture toughness of the pipe is fully aged and is therefore acceptable for use in the flaw evaluation. Therefore, TLAA is not a concern for the thermal aging of the material because the fully-aged material properties were used in the flaw evaluation.

The transients considered in the flaw evaluation are the design transients contained in the equipment specification. The transients used in the flaw analysis were considered to be conservative, relative to the original design transients. The staff confirmed that as demonstrated in LRA Table 4.3-2, the Unit 1 original design transients bound the 60-year projected cycles. To verify the flaw growth evaluation remains valid for 60 years, the applicant will use the Metal Fatigue of Reactor Coolant Pressure Boundary Program to validate the cycles assumed in the flaw evaluation.

The staff finds that this program is acceptable to address the TLAA concern regarding the fatigue crack growth analysis.

During its response to a staff RAI, the applicant discovered that the subject flaw evaluation was not updated using loading conditions derived from the extended power uprate and steam generator replacement projects. The applicant addressed this deficiency under its Corrective Action Program. Since then, the applicant has completed a review of the original flaw evaluation previously performed for the indication at weld DLW-LOOP3-7-S-02 in accordance with the flaw evaluation procedure and acceptance criteria pursuant to ASME Code Section XI, 1989 Edition.

The applicant assessed the impact of the following items on the previous flaw evaluation results: (1) applicable thermal transients reflecting the extended power uprate conditions; (2) latest piping reaction loads reflecting extended power uprate conditions, including the replacement steam generators; and (3) thermal aging and/or facture toughness in accordance with guidance found in NUREG/CR-4513, Revision 1. The results of this assessment showed that the indication at weld DLW-LOOP3-7-S-02 would remain acceptable for the duration of plant life, including the license renewal period. The staff finds that the applicant has demonstrated that the original flaw evaluation of weld DLW-LOOP3-7-S-02 bounds the power uprate conditions.

The staff finds that the applicant has satisfactorily addressed the relevant TLAA issues for the indication detected in the RCS loop C cold leg and concludes that the indication should not be of concern for the period of extended operation. The staff also finds that the effects of aging on the intended function of the RCS Loop C cold leg will be adequately managed for the period of extended operation.

4.7.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the indication on the Unit 1 RCS loop C cold leg in LRA Section A.2.6.1. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address the TLAA evaluation of the subject indication is adequate.

4.7.1.4 Conclusion

Based on its review, the staff concludes that pursuant to 10 CFR 54.21(c)(1)(i), the applicant has demonstrated that the flaw evaluation of the indication on the RCS loop C cold leg at Unit 1 remains valid for the period of extended operation because the applicant used the saturated CASS material properties and projected transient cycles to 60 years. The staff further concludes that, pursuant to 10 CFR 54.21(c)(1)(iii), the applicant has demonstrated that the effects of aging on the intended functions of the RCS cold leg will be adequately managed for the period of extended operation. The UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.2 Reactor Vessel Underclad Cracking (Unit 1 Only)

4.7.2.1 Summary of Technical Information in the Application

In LRA Section 4.7.2, the applicant summarized its evaluation of RV underclad cracking (Unit 1 only) for the period of extended operation. Examination of Nucleoelectrica Argentina SA's Atucha-1 RV in 1970 first detected intergranular separations (underclad cracking) in low-alloy steel heat-affected zones under austenitic stainless steel weld claddings in SA-508, Class-2 RV forgings. There have been reports of these separations in SA-508, Class 2, RV forgings manufactured to a coarse-grain practice and clad by high-heat-input submerged arc processes. RG 1.43, "Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components," states that detection of underclad cracks "normally requires destructively removing the cladding to the weld fusion line and examining the exposed base metal either by metallographic techniques or with liquid penetrate or magnetic particle testing methods." The WOG issued topical report WCAP-15338-A, "A Review of Cracking Associated with Weld Deposited Cladding in Operating PWR Plants," on flaw evaluations based on ASME Code Section XI to demonstrate that the Westinghouse reactor pressure vessels with underclad cracks are acceptable for 60 years.

For the Unit 2 RV, the cladding of the RV SA-508 Class 2 forgings used no high-heat-input welding processes which could induce underclad cracking; therefore, the Unit 2 RV is not susceptible to underclad cracking.

The Unit 1 RV has no SA-508, Class 2 forgings in the beltline regions. Only the vessel and closure head flanges and inlet and outlet nozzles are fabricated from SA-508, Class 2 forgings.

The WCAP-15338-A evaluation demonstrates that fatigue growth of the subject flaws will be minimal over 60 years and that the presence of underclad cracks is of no concern to the structural integrity of the RV.

The cycle assumptions in the flaw growth analysis are conservative compared to the original design cycles. LRA Table 4.3-2 shows the original design-basis transients including RCS design cycles along with the projected operational cycles that the applicant anticipates will occur for 60 years of plant life. The applicant has compared the design cycles to the 60-year projected operational cycles and determined that the design cycles are bounding for the period of extended operation. Since the applicant determined that the flaw growth analysis remains valid for 60 years using the 60-year projected operational cycles, the Metal Fatigue of Reactor Coolant Pressure Boundary Program must continue to validate the assumptions in the evaluation; therefore, disposition of the Unit 1 flaw growth TLAA complies with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(iii).

4.7.2.2 Staff Evaluation

The staff reviewed LRA Section 4.7.2, to verify pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Intergranular cracking in low-alloy steel RV plates and forgings underneath stainless steel weld cladding (*i.e.*, underclad cracking) has been observed for specific materials and cladding process conditions. According to RG 1.43, “Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components,” May 1973, underclad cracking has been reported only in RV forgings and plates of SA-508 Class 2 composition 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. Westinghouse Topical Report WCAP-15338-A, “A Review of Cracking Associated with Weld Deposited Cladding in Operating PWR Plants,” October 2002, provides flaw evaluations for postulated underclad cracks based on the flaw evaluation guidelines in ASME Code, Section XI.

Given bounding assumptions with respect to cyclic loading, these flaw evaluations demonstrate that Westinghouse RVs with underclad cracks can operate safely and in compliance with regulatory requirements for 60 years.

In LRA Section 4.7.2, the applicant discussed its TLAA for the RV underclad cracking mechanism at Unit 1. The applicant stated that no high-heat-input welding processes which could induce RV underclad cracking were used in the cladding of the SA-508 Class 2 RV materials at Unit 2. Therefore, the Unit 2 RV was not deemed susceptible to underclad cracking. Only the RV closure head flange, inlet nozzles, and outlet nozzles for Unit 1 are fabricated from SA-508 Class 2 material subjected to high-heat-input welding processes; therefore, these items were deemed susceptible to underclad cracking. The applicant stated that the evaluation contained in WCAP-15338-A was used to demonstrate that the fatigue crack growth of any underclad cracks will be minimal over 60 years, and that the presence of the underclad cracks does not present a safety concern with respect to the structural integrity of the Unit 1 RV. The applicant provided original design cycles and 60-year projected operational cycles for Unit 1 and Unit 2 in LRA Table 4.3-2. The applicant indicated that the cycle assumptions used in the WCAP-15338-A flaw growth analysis are conservative (*i.e.*, greater) compared to the original design cycles for the Unit 1 RCS. Furthermore, the applicant explained that it had reviewed the original design cycles against the 60-year projected operational cycles and determined that the original design cycles for Unit 1 remain bounding for the period of extended operation.

RG 1.43 states that underclad cracking has been reported only in forgings and plate material of SA-508 Class 2 composition, fabricated to a coarse-grain practice when clad using "high-heat-input" submerged arc welding processes. Underclad cracking has not been observed in SA-508 Class 2 materials clad by "low-heat-input" welding processes, which are controlled to minimize heating of the base metal. Furthermore, underclad cracking has not been observed in materials produced to a fine grain practice, regardless of the welding practice. Therefore, the staff agreed with the applicant's determination that the Unit 2 RV is not susceptible to underclad cracking because high-heat-input welding processes were not used in the cladding of the SA-508 Class 2 RV materials. For Unit 1, the staff confirmed that the original design cycles and 60-year projected operational cycles, as reported in LRA Table 4.3-2, are bounded by the cycle assumptions used in the flaw growth analysis in WCAP-15338-A. Therefore, the staff agreed with the applicant's determination that the presence of any underclad cracks in components fabricated from SA-508, Class 2 material would not significantly impact the structural integrity of the Unit 1 RV through the end of the period of extended operation.

The applicant stated that since the 60-year projected operational cycles were used to determine that the flaw growth analysis in WCAP-15338-A remains bounding for 60 years, the Metal Fatigue of Reactor Coolant Pressure Boundary program described in LRA Section B.2.27 must continue to be used to validate the assumptions for the design cycles and 60-year operational cycles used in this TLAA. The Metal Fatigue of Reactor Coolant Pressure Boundary Program is a TLAA management program that uses preventive measures to mitigate fatigue cracking caused by anticipated cyclic strains in metal components of the RCPB.
The preventive measures consist of monitoring and tracking critical thermal and pressure transients for RCS components to prevent the fatigue design limit from being exceeded. Therefore, the staff finds that the applicant's implementation of this AMP will ensure that the Unit 1 RV underclad cracking TLAA will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.2.3 UFSAR Supplement

In LRA Section A.2.6.2, the applicant provided the UFSAR supplement summary description of the RV underclad cracking TLAA for Unit 1. The staff reviewed the applicant's UFSAR supplement summary description and determined that it is consistent with the RV underclad cracking TLAA in LRA Section 4.7.2. The UFSAR supplement states that the RV underclad cracking TLAA for Unit 1 will be managed through the implementation of the RCPB Metal Fatigue program through the end of the period of extended operation. The staff therefore determines that the Unit 1 UFSAR supplement summary description of the RV underclad cracking TLAA is acceptable.

4.7.2.4 Conclusion

The staff has reviewed the applicant's TLAA for RV underclad cracking, as summarized in LRA Section 4.7.2 and determines that the RV underclad cracking TLAA at Unit 1 will be managed through the applicant's implementation of the RCPB Metal Fatigue program to ensure compliance with 10 CFR 50.55a and 10 CFR Part 50, Appendix G, through the end of the period of extended operation. The staff therefore concludes that the applicant's TLAA for RV underclad cracking at Unit 1 complies with the staff's acceptance criterion for TLAAs in 10 CFR 54.21(c)(1)(iii) and that the safety margins established and maintained during the current operating term will be maintained during the period of extended operation, as required by 10 CFR 54.21(c)(1). The staff also concludes that the UFSAR supplement for Unit 1 contains an appropriate summary description of the RV underclad cracking TLAA for the period of extended operation, as required by 10 CFR 54.21(d).

4.7.3 Leak-Before-Break

4.7.3.1 Main Coolant Loop Piping Leak-Before-Break

4.7.3.1.1 Summary of Technical Information in the Application

The current LBB evaluation for the Unit 1 main coolant loop piping is documented in WCAP-11317, "Technical Justification for Eliminating Large Primary Loop Pipe Rupture as the Structural Design Basis for Beaver Valley Unit 1." By letter dated December 9, 1987, the staff approved LBB for the main coolant loop piping based on its review of WCAP-11317 (including Supplements 1 and 2). The applicant evaluated WCAP-11317 to determine whether elimination of the pipe breaks remains justified at power uprate operating conditions and whether the fracture toughness values calculated in WCAP-11317 were conservative. The LBB analyses for Unit 1 main coolant loop piping in WCAP-11317 includes CASS thermal aging and fatigue crack growth analysis. The current LBB evaluation for the Unit 2 main coolant loop piping is documented in WCAP-11923, "Technical Justification for Eliminating Large Primary Loop Pipe Rupture as the Structural Design Basis for Beaver Valley Unit 2 After Reduction of Snubbers." By letter dated April 8, 1991, the staff approved LBB for the Unit 2 main coolant loop piping based on its review of WCAP-11923. The applicant evaluated WCAP-11923 to determine whether elimination of the pipe breaks remains justified at power uprate operating conditions and whether the fracture toughness values calculated in WCAP-11923 were conservative. The LBB analyses for Unit 2 main coolant loop piping in WCAP-11923 includes CASS thermal aging and fatigue crack growth analysis.

The Unit 1 and 2 primary loop piping material is made of CASS. With CASS, thermal aging continues until the saturation or fully-aged point is reached. The LBB evaluations for both units use saturated (fully-aged) fracture toughness properties that are not material property time-dependent; thus, no further evaluation is required for license renewal. There is no thermal aging TLAA in the Unit 1 or Unit 2 main coolant loop piping LBB evaluations. Over time, accumulation of actual fatigue transient cycles could invalidate fatigue crack growth analyses. The applicant performed a fatigue crack growth analysis of the RV inlet nozzle to safe-end region to determine its sensitivity to the presence of small cracks.

The applicant selected the nozzle to safe-end connection because crack growth at this location is representative of the entire primary loop. The nozzle to safe-end connection configuration includes an SA-508 Class 2 or Class 3 stainless steel-clad nozzle connected to a stainless steel safe-end by a stainless steel (Unit 1) or nickel-based alloy (Unit 2) weld. The applicant used fatigue crack growth rate laws pursuant to ASME Code Section XI to evaluate the crack growth.

The applicant stated that the cycles used in the fatigue crack growth analyses are conservative compared to the original design cycles. LRA Table 4.3-2 shows the original design-basis transients including RCS design cycles, along with the projected operational cycles for 60 years of plant life. The applicant has determined that the design cycles are bounding for the period of extended operation. Because the 60-year projected operational cycles were used in the evaluation, the applicant will continue to use the Metal Fatigue of Reactor Coolant Pressure Boundary Program to validate the cycles assumed in the evaluation.

4.7.3.1.2 Staff Evaluation

The staff reviewed LRA Section 4.7.3.1 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the LBB analyses for the main coolant loop piping remain valid for the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function of the main coolant piping will be adequately managed for the period of extended operation.

The TLAA concerns are thermal aging of the cast material and fatigue crack growth analyses of the subject piping because these two issues are time-dependent. The applicant performed the fatigue crack growth analyses based on a finite element stress analysis for the inlet nozzle safe-end region of a generic plant, typical in geometry and operational characteristics to any Westinghouse PWR System. The specific system was a plant with a piping outside diameter of 33 inches, and a wall thickness of 2.85 inches. The corresponding dimensions for Unit 1 are 34.0 inches in diameter and 3.27 inches wall thickness. The corresponding dimensions for Unit 2 are 32.46 inches in diameter and 2.5 inches wall thickness. The difference in dimensions between the typical Westinghouse plant and the Beaver Valley plants is insignificant as far as fatigue crack growth analysis is concerned. The calculated fatigue crack growth for semi-elliptic surface flaws of circumferential orientation and various depths shows that crack growth is small. The transient cycles used in the fatigue crack growth analyses are conservative compared to the original design cycles. LRA Table 4.3-2 shows the original design-basis transients, including RCS design cycles, along with the projected operational cycles for 60 years of plant life. The staff determined that the design cycles used in the fatigue crack growth analysis are bounding for 60 years of operation and that the applicant will continue to use the Metal Fatigue of Reactor Coolant Pressure Boundary Program to validate the cycles assumed in its evaluation. The staff finds that the applicant has satisfactorily addressed the TLAA concern regarding the fatigue crack growth analyses of the main coolant loop piping.

The applicant stated that the Unit 1 and Unit 2 main coolant loop piping are fabricated from CASS. Therefore, the thermal embrittlement of the CASS material could be a TLAA concern because thermal embrittlement is time-dependent. The applicant used the saturated fracture toughness for the CASS components in its LBB evaluation. The saturated fracture toughness is the lowest (the worst) fracture toughness that the CASS material can reach. Fracture toughness cannot be reduced any lower than the saturated value regardless of the time. The applicant has used saturated fracture toughness to show that main coolant piping satisfies the acceptance criteria of LBB. Therefore, the staff finds that the thermal embrittlement of the CASS piping is not a TLAA concern for Units 1 and 2.

By letter dated May 19, 2000, Christopher I. Grimes of the NRC forwarded to Douglas J. Walters of Nuclear Energy Institute, guidelines on how CASS components should be managed to minimize thermal aging of CASS components. In light of this letter, the staff asked the applicant in RAI 4.7.3-6 dated April 1, 2008, to discuss whether the CASS components in the LBB piping at Units 1 and 2 satisfy the staff guidance in its May 19, 2000 letter. The applicant clarified in a letter dated June 2, 2008 that GALL AMP XI.M12, “Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)”, incorporates the staff positions in its evaluation dated May 19, 2000. The applicant noted that its Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is a new AMP that will be consistent with GALL AMP XI.M12.

The applicant will use its Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program to monitor the effects of loss of fracture toughness on the intended function of the component by identifying CASS materials that are susceptible to thermal aging embrittlement. For potentially susceptible materials that are part of the RCPB, the program will consist of either volumetric examination of the base metal or a component-specific flaw tolerance evaluation. The staff's evaluation of the applicants Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is shown in SER Section 3.0.3.1.22.

The staff finds that the applicant will use its Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program to monitor the potential thermal embrittlement of the CASS components. The applicant also will use the saturated fracture toughness for the CASS components. Therefore, the staff finds that thermal embrittlement of the CASS material will be managed satisfactorily for the main coolant piping. Therefore, the issue raised by RAI 4.7.3-6 is resolved.

As discussed in SER Section 4.7.1, in 1996, the applicant detected an indication on the RCS loop C cold leg between the elbow and a Section of straight pipe. In RAI 4.7.3-2, dated April 1, 2008, the staff requested that the applicant discuss whether this indication is located on a segment of the pipe that has been staff-approved for LBB. If so, the staff requested that the applicant discuss whether the assumptions in the LBB analyses are still valid in light of the indication, and discuss whether the indication was fabrication or service induced.

In its response to RAI 4.7.3-2, dated June 2, 2008, the applicant confirmed that the subject flaw indication is located on a segment of the pipe (in the weld) that has been approved for LBB as shown in WCAP11317. In general, the staff-approved LBB approach excludes piping with active degradation mechanism for LBB. As stated in the *Leak-Before-Break Evaluation Procedures* published in the *Federal Register* (52 FR 32626): "Piping susceptible to IGSCC [inter-granular stress corrosion cracking] with any planar flaws in excess of the standards in IWB 3514.3 of Section XI of the ASME Code, would not be permitted to use leak-before-break analysis." The applicant stated that the piping in this case, as discussed in SER Section 4.7.1, is not susceptible to SCC based on the conclusions of the original flaw analysis for weld DLW-LOOP3-7-S-02. The potential for SCC is minimized by assuring that materials selections are compatible with the plant operating parameters and a corrosive environment is not present.

As documented in a follow-up letter dated May 1, 1996, the applicant reviewed the results of the video and eddy current examinations of the inside diameter (ID) surface of the RCS loop C cold leg. The applicant verified that there was no surface breaking indications or geometric irregularities on the ID surface. The lack of any ID surface breaking indication provides assurance that there is no need to address in-service failure mechanisms. The weld was reexamined during the first two 40-month periods (first and second periods of the third ISI Interval) following discovery, and the results indicated that no measurable growth was observed in the flaw since the initial examination. This provides additional confirmation that the indication was not a result of SCC and confirms that the LBB analysis remains valid.

The staff finds that the indication in the RCS loop C cold leg is not caused by an active degradation mechanism. Therefore, the current LBB evaluation is valid because the cold leg does not have an active degradation mechanism. On this basis, this issue raised by RAI 4.7.3-6 is resolved.

Operating experience has shown that nickel-based Alloy 600/82/182 material in the PWR environment is susceptible to primary water stress-corrosion cracking (PWSCC). In light of this emerging issue, the applicant clarified that there is no Alloy 82/182 weld metal or Alloy 600 components in the Unit 1 primary (main) loop piping. The applicant stated that the Unit 2 main coolant loop piping (RV inlet/outlet nozzles safe-end welds) and Unit 2 pressurizer surge line piping (pressurizer surge nozzle safe-end weld) contain Alloy 600/82/182 material. At this time, the applicant has no plans to perform full structural weld overlays or mechanical stress improvement of the Unit 2 main coolant inlet/outlet nozzles safe-end welds to reduce their susceptibility to PWSCC. The applicant examined the Unit 2 main coolant inlet/outlet nozzles safe-end welds using Performance Demonstration Initiative-qualified ultrasonic examination techniques in the spring of 2008. The applicant obtained greater than 90 percent ultrasonic examination coverage at all six dissimilar metal-weld locations, with no recordable indications identified.

The future inspection frequency of the Alloy 600/82/182 components will be determined by the applicant’s BVPS Nickel-Alloy Nozzles and Penetrations Program. Implementation of this program is commitment 15 in the LRA Table A.4-1 and commitment 17 in Table A.5-1, for Units 1 and 2 respectively. The staff finds that the commitments in LRA Tables A.4-1 and A.5-1 are acceptable. However, the staff notes that the future inspection frequency and methods of the Alloy 600/82/182 components may be dictated by future ASME Code requirements, industry guidance, or NRC regulations for the inspection of the Alloy 600/82/182 components.

The applicant updated the current LBB analyses (WCAP-11317 and WCAP-11923) to address extended power uprate conditions on the main loop piping. The loadings, operating pressure and temperature parameters for the extended power uprate were used in the evaluation. The parameters important in the evaluation are the piping forces, moments, normal operating temperature, and normal operating pressure.

These parameters were used in the evaluation. The evaluation results show that the LBB conclusions provided in the current LBB analyses for Unit 1 and Unit 2 remain unchanged for the extended power uprate conditions. The staff confirms that the changes in the applied piping loads due to extended power uprate conditions are not sufficiently significant to change the results of the current LBB analyses.

The staff finds that the applicant has satisfactorily performed TLAA of the LBB analyses for the main coolant loop piping.

The staff also finds that the applicant has addressed the effects of PWSCC of Alloy 82/182 dissimilar metal welds and has satisfactorily evaluated the impact of the extended power uprate conditions on the subject piping; therefore, the effects of aging on the intended function of the main coolant piping will be adequately managed for the period of extended operation.

4.7.3.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of main coolant loop piping LBB in LRA Sections A.2.6.3.1 and A.3.6.1.1. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant’s actions to address main coolant loop piping LBB is adequate.

4.7.3.1.4 Conclusion

Based on its review, the staff concludes that pursuant to 10 CFR 54.21(c)(1)(i), the applicant has demonstrated that main coolant loop piping LBB analyses remain valid for the period of extended operation. The staff further concludes that pursuant to 10 CFR 54.21(c)(1)(iii), the applicant has demonstrated that the effects of aging on the intended function of the main coolant loop piping will be adequately managed for the period of extended operation. The UFSAR supplement contains an appropriate summary description of the TLAA evaluation of the main coolant loop piping, as required by 10 CFR 54.21(d).

4.7.3.2 Pressurizer Surge Line Piping Leak-Before-Break

4.7.3.2.1 Summary of Technical Information in the Application

The current LBB evaluation for the Unit 1 pressurizer surge line piping is documented in WCAP-12727, "Evaluation of Thermal Stratification for the Beaver Valley Unit 1 Pressurizer Surge Line." The staff approved LBB for the Unit 1 pressurizer surge line based on its May 2, 1991 review of WCAP-12727. The applicant evaluated WCAP-12727 to determine whether elimination of the Unit 1 pressurizer surge line pipe breaks from the structural design basis remains justified at power uprate operating conditions. The Unit 1 surge line piping, fabricated from wrought austenitic stainless steel, is not susceptible to reduction of fracture toughness by thermal embrittlement. Therefore, the only TLAA for Unit 1 pressurizer surge line in WCAP-12727 requiring disposition for license renewal is the fatigue crack growth analysis.

The current LBB evaluation for the Unit 2 pressurizer surge line piping is documented in WCAP-12093, "Evaluation of Thermal Stratification for the Beaver Valley Unit 2 Pressurizer Surge Line." The staff approved LBB for the Unit 2 pressurizer surge line based on its January 18, 1990 review of WCAP-12093, including Supplements 1 and 2. The LBB analyses were based on a maximum temperature difference of 315°F between the pressurizer and the hot leg. After the staff approved LBB for the Unit 2 pressurizer surge line in 1990, the plant experienced a system temperature difference of approximately 360°F during heatup. To address this issue, the applicant prepared and submitted WCAP-12093-P, Supplement 3, "Evaluation of Pressurizer Surge Line Transients Exceeding 320°F for Beaver Valley Unit 2," (proprietary). The staff approved WCAP-12093-P, Supplement 3, on April 8, 1991. The applicant concluded that this larger temperature difference does not significantly affect the maximum stress intensity, fatigue usage factor, or growth of postulated cracks nor does it impact the 40-year design life. In addition, the applicant revised its operating procedures to ensure that a 320°F system temperature difference would not be exceeded.

The applicant studied the Unit 2 pressurizer surge line LBB evaluation to determine whether elimination of pressurizer surge line pipe breaks from the structural design basis remains justified at power uprate operating conditions. The Unit 2 surge line piping, fabricated from wrought austenitic stainless steel, is not susceptible to reduction of fracture toughness by thermal embrittlement. Therefore, the only TLAA for Unit 2 pressurizer surge line in WCAP-12093 and its supplements requiring disposition for license renewal is the fatigue crack growth analysis.

The applicant's fatigue crack growth analyses of selected pressurizer surge line locations determined sensitivity to the presence of small cracks. The accumulation of actual fatigue transient cycles is the one factor in the Units 1 and 2 analyses that could be influenced by time; therefore, the fatigue crack growth analyses reported in WCAP-12727 and WCAP-12093 (including supplements) could be invalidated.

The cycle assumptions in the fatigue crack growth analyses are conservative compared to the applicant's original design cycles. LRA Table 4.3-2 shows the applicant's original design basis transients, including RCS design cycles along with the projected operational cycles for 60 years of plant life. The applicant has compared the design cycles against the 60-year projected operational cycles and has determined that the design cycles are bounding for the period of extended operation. To ensure that the 60-year projected operational cycles remain valid, the applicant will use its Metal Fatigue of Reactor Coolant Pressure Boundary Program to validate the cycles assumed in the LBB evaluation.

4.7.3.2.2 Staff Evaluation

The staff reviewed LRA Section 4.7.3.2 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the LBB analyses remain valid for the period of extended operation and pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The TLAA concerns of the LBB analyses are thermal aging of the cast material and fatigue crack growth analyses. The pressurizer surge piping in Units 1 and 2 are made of wrought austenitic stainless steel which is not susceptible to thermal embrittlement. Therefore, fatigue crack growth analyses are the only TLAA of concern for Units 1 and 2 because they are time-dependent.

The accumulation of actual fatigue transient cycles is the only factor in the Units 1 and 2 LBB analyses that could be influenced by time; therefore, the fatigue crack growth analyses reported in WCAP-12727 and WCAP-12093 (including supplements), could be invalidated. The staff confirmed that a range of locations were evaluated, representing various cross sections of the surge line where thermal stratification could occur for fatigue crack growth. The circumferential positions are controlling positions because the global structural bending stress is maximum at two of the positions, while the local axial stress on the inside surface is maximum at two of the other positions. The largest initial flaw assumed to exist had a depth equal to ten percent of the wall thickness, which is the maximum acceptable flaw size pursuant to ASME Code Section XI. The wall thickness is 1.41 inches. The initial flaw depth used in the fatigue crack growth analysis is 0.141 inches. The maximum depth of crack growth after full service life was 0.347 inches, which was less than 25% of the nominal wall thickness.

The cycle assumptions in the fatigue crack growth analyses are conservative compared to the applicant's original design cycles. LRA Table 4.3-2 shows the applicant's original design basis transients, including RCS design cycles and the projected operational cycles for 60 years of plant life. The staff determines that the design cycles used in the fatigue crack growth analysis are bounding for 60 years of plant life. To ensure that the 60-year projected operational cycles remain valid, the applicant will continue to use its Metal Fatigue of Reactor Coolant Pressure Boundary Program to count the exact operational cycles to validate the assumed cycles in the LBB evaluation.

As stated above, the applicant experienced a system temperature difference of about 360°F during Unit 2 plant heatup. In RAI 4.7.3-3, dated April 1, 2008, the staff requested that the applicant clarify whether the original LBB analysis has been evaluated with a 360°F temperature difference, and whether the cycle counts in LRA Table 4.32 include this temperature transient in the LBB analysis.

In its response to RAI 4.7.3-3, dated June 2, 2008, the applicant responded that as presented in WCAP-12093-P, Supplement 3 and submitted to the staff on August 10, 1990, the characteristics of the thermal stratification transients were discussed. WCAP-12093, Supplement 3 evaluated the original LBB analysis with the addition of the observed 360°F temperature difference that occurred during a Unit 2 plant heatup. Specifically, the observed 360°F transient scenario was postulated to consist of one transient of 360°F, one transient of 342°F and three transients of 320°F. This is in addition to every design cycle developed in the original LBB analysis. The Unit 2 plant heatup is included in the operational cycle count (operational cycles as of October 15, 2003) in LRA Table 4.3-2. WCAP-12093, Supplement 3 concludes that the maximum stress intensity, fatigue usage factor, and growth of postulated cracks are not significantly affected by the observed transient of 360°F and that the design life is not affected by this larger temperature difference.

The staff confirmed that the analysis of the unanalyzed condition showed that the design life of the pipe is not affected by the 360°F temperature transient.

The applicant clarified in its response to RAI 4.7.3-4 dated June 2, 2008 that the Units 1 and 2 operating procedures were revised to include a requirement to verify that the pressurizer to C loop hot leg differential temperature is less than 320°F when the conditions to start a RCP are established during heatup. Otherwise, the RCS temperature shall be raised to reduce the differential temperature to less than 320°F prior to start of an RCP. Therefore, this operating restriction is sufficient to preclude exceeding the 320°F differential temperature design limit between the pressurizer and the hot leg during heatup.

With regard to the impact of power uprate to the pressurizer surge lines, the applicant updated the current LBB analyses (WCAP-12727 and WCAP-12093) to address extended power uprate conditions. The applicant determined the impact of the loadings and other parameters on the LBB analysis due to the extended power uprate conditions. The results of the evaluation show that all the LBB acceptance criteria and recommended margins are satisfied at the extended power uprate conditions. The staff finds that the applicant has demonstrated that the LBB evaluation of the pressurizer surge lines in Units 1 and 2 remain valid for the extended power uprate operating conditions.

The staff is also concerned with the emerging issue of PWSCC occurrence in Alloy 82/182 dissimilar metal butt welds. In its June 2, 2008 letter, the applicant confirmed that there is no Alloy 82/182 weld metal or Alloy 600 components in the Unit 1 pressurizer surge line piping. Therefore, the likelihood of PWSCC affecting the butt welds in the Unit 1 pressurizer surge line is small.

The Unit 2 pressurizer surge line does contain an Alloy 82/182 dissimilar metal weld. The applicant has installed a full structural weld overlay on the Alloy 82/182 dissimilar metal weld of the pressurizer surge line during RFO 12 (October 2 to November 12, 2006) for Unit 2. The applicant ultrasonically examined the subject Alloy 82/182 weld following structural weld overlay in the Fall of 2006. The applicant performed the examination on the required inspection volume in the weld overlay and outer 25 percent of the original dissimilar metal weld using Performance Demonstration Initiative-qualified ultrasonic examination techniques and found no recordable indications. The staff finds that the applicant has addressed PWSCC of the Alloy 82/182 dissimilar metal weld appropriately by installing the weld overlay.

The staff finds that the applicant has satisfactorily performed TLAA evaluation of the fatigue crack growth analysis and has implemented the Metal Fatigue of Reactor Coolant Pressure Boundary Program to monitor the operating cycles. The staff further finds that the effects of aging on the intended function of the pressurizer surge lines Units 1 and 2 will be adequately managed for the period of extended operation.

4.7.3.2.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA of the LBB analyses for the Units 1 and 2 pressurizer surge lines in LRA Sections A.2.6.3.2 and A.3.6.1.2. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address TLAA of the LBB analyses for the pressurizer surge lines in Units 1 and 2 is adequate.

4.7.3.2.4 Conclusion

Based on its review, the staff concludes that pursuant to 10 CFR 54.21(c)(1)(i), the applicant has demonstrated that the LBB analysis for the Units 1 and 2 pressurizer surge lines remains valid for the period of extended operation, and pursuant to 10 CFR 54.21(c)(1)(iii), the applicant has demonstrated that the effects of aging on the intended function of the Units 1 and 2 pressurizer surge lines will be adequately managed for the period of extended operation. The UFSAR supplement contains an appropriate summary description of the TLAA evaluation of the Units 1 and 2 pressurizer surge lines, as required by 10 CFR 54.21(d).

4.7.3.3 Branch Line Piping Leak-Before-Break (Unit 2 Only)

4.7.3.3.1 Summary of Technical Information in the Application

Unit 1 has not implemented LBB on any branch line piping segments. The staff approved the LBB evaluations for the Unit 2 branch line piping in NUREG-1057, Supplement No. 4, "Safety Evaluation Report Related to the Operation of Beaver Valley Power Station Unit 2," March 1987. There are no cast materials for the subject Unit 2 piping; therefore, thermal aging of the Unit 2 branch lines is not a TLAA concern. The applicant calculated fatigue crack growth at the piping limiting locations based on a postulated conservative crack. The analysis result showed that, after a 40-year plant life, the crack would not grow to a 100% through-wall size. The fatigue transients for the crack growth evaluations were in accordance with ASME Code, Section III, Class 1 stress analyses for the particular line. As these fatigue transients and the resulting crack growth evaluation are based on a 40-year plant life, the Unit 2 branch piping LBB evaluations are TLAAs requiring disposition for the period of extended operation.

The applicant's fatigue crack growth analyses of selected RCS, RHR, and safety injection system (SIS) loop bypass line locations determined sensitivity to the presence of small cracks.

The time-dependent factor in the LBB evaluation for the Unit 2 branch lines is actual fatigue transient cycles; therefore, the fatigue crack growth analyses could be invalidated.

The applicant assumed a conservative number of cycles in its fatigue crack growth analyses compared to the Unit 1 and 2 original design cycles. LRA Table 4.3-2 shows the Units 1 and 2 original design basis transients including RCS design cycles along with the projected operational cycles for 60 years of plant life. The applicant has compared the design cycles against the 60-year projected operational cycles and determined that the design cycles are bounding for the period of extended operation. To determine the validity of the fatigue crack growth analyses for 60 years, the applicant will continue to use the Metal Fatigue of Reactor Coolant Pressure Boundary Program to validate the assumptions in the LBB evaluation.

4.7.3.3.2 Staff Evaluation

The staff reviewed LRA Section 4.7.3.3 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the applicant's LBB analyses of the Unit 2 branch lines remain valid for the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions of the branch lines will be adequately managed for the period of extended operation.

The TLAA concerns are thermal aging of the cast material and fatigue crack growth analyses of the branch lines. As stated above, the applicant has not requested the application of LBB on any Unit 1 branch lines. Therefore, the staff evaluated only the Unit 2 branch lines in terms of TLAA. The staff confirmed that there are no cast materials used in the Unit 2 branch lines. Therefore, thermal aging of the branch lines in Unit 2 is not a TLAA concern. The fatigue crack growth, which is time-dependent, is the only TLAA concern for the Unit 2 branch lines.

The staff has approved the following Unit 2 branch lines for LBB: a 10-inch RHR discharge line, a 12-inch RHR suction line, 6-inch SIS lines to hot leg and cold leg, 8-inch RCS loop bypass lines, 12-inch SIS accumulator injection lines, and the 14-inch pressurizer surge line. The applicant's LBB evaluation for the Unit 2 RCL branch line piping is documented in the *WHIPJET Program Final Report,* January 30, 1987, which includes the fatigue crack growth analysis. The staff approved the applicant's LBB evaluation in NUREG-1057, Supplement Number 4, March 1987.

The staff finds that the applicant's fatigue crack growth calculations of the Unit 2 branch lines were performed at the limiting locations based on normal and safe shutdown earthquake loads. The applicant assumed a conservative crack that exceeds the ASME Code Section XI acceptance criteria. The calculated fatigue crack growth results show that the final fatigue crack is less than the pipe wall thickness; therefore, the potential for leakage in the branch lines is small. In addition, the cycles assumed in the fatigue crack growth analyses are conservative compared to the Unit 2 original design cycles. The staff confirmed that the Unit 2 original design basis transients are bounding for the 60-year projected operational cycles. The applicant will continue to use the Metal Fatigue of Reactor Coolant Pressure Boundary Program to count the actual operating cycles in order to validate the cycle assumptions in the LBB evaluation.

The staff finds that the applicant has satisfactorily performed TLAA evaluation of fatigue crack growth calculation and has implemented the necessary AMP to monitor the operating cycles.

The applicant clarified that the LBB evaluations performed for the Unit 2 branch lines remain valid for the extended power uprate conditions based on a letter dated October 4, 2004, Pearce, L. W. (FENOC), “Beaver Valley Power Station Unit No. 1 and No. 2, BV-1 Docket No. 50-334, License No. DPR-66, BV-2 Docket No. 50-412, License No. NPF-73, License Amendment Request No. 302 and 173.” The branch line piping forces and moments, operating pressure, temperature, and material properties were the important input parameters for the previous WHIPJET evaluation. The applicant evaluated the impact of extended power uprate conditions on these input parameters as one percent or less. Therefore, the staff finds that the Unit 2 branch lines are insignificantly affected and remain acceptable for extended power uprate conditions.

The staff also evaluated the branch lines with regard to the emerging issue of PWSCC in Alloy 82/182 butt welds. The applicant stated that there is no Alloy 82/182 weld metal or Alloy 600 components in the Unit 2 branch line piping (RHR, SIS and RCS loop bypass lines). Therefore, the likelihood of PWSCC affecting the dissimilar metal butt welds in the branch lines is small. The staff notes that the pressurizer surge line does contain an Alloy 82/182 butt weld. The disposition of the pressurizer surge line with respect to PWSCC is discussed in SER Section 4.7.3.2.

The staff finds that the TLAA of the LBB analyses of the Unit 2 branch lines remain valid for the period of extended operation.

The staff also finds that the effects of aging on the intended functions of the Unit 2 branch lines will be adequately managed for the period of extended operation.

4.7.3.3.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA of the LBB analyses for Unit 2 branch lines in LRA Section A.3.6.1.3. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant’s actions to address the Unit 2 branch line LBB analyses is adequate.

4.7.3.3.4 Conclusion

Based on its review, the staff concludes that pursuant to 10 CFR 54.21(c)(1)(i), the applicant has demonstrated that the LBB analyses of the Unit 2 branch line remain valid for the period of extended operation and that pursuant to 10 CFR 54.21(c)(1)(iii), the applicant has also demonstrated that the effects of aging on the intended function of the Unit 2 branch lines will be adequately managed for the period of extended operation. The UFSAR supplement contains an appropriate summary description of the TLAA evaluation of the Unit 2 branch lines, as required by 10 CFR 54.21(d).

4.7.4 High-Energy Line Break Postulation

4.7.4.1 Summary of Technical Information in the Application

In LRA Section 4.7.4, the applicant summarized its evaluation of High Energy Line Break (HELB) postulation for the period of extended operation. In accordance with 10 CFR 50, Appendix A, GDC 4, “Environmental and Dynamic Effects Design Bases,” the applicant has taken special measures in the design and construction of Units 1 and 2 to protect systems, structures or components required to place the reactor in a safe cold shutdown condition from the dynamic effects of postulated rupture of piping.

The applicant stated that as described in UFSAR Section 5.2.6.3 for Unit 1, specific placement of piping and components (protection barriers) ensures compliance with this criterion. The careful layout of piping and components offers adequate protection against the dynamic effects of a postulated pipe rupture, except in the main steam and feedwater lines outside the crane wall. For these two piping systems, the applicant used RG 1.46, "Protection Against Pipe Whip Inside Containment," as the base document for evaluation of the break locations. The applicant designed the Unit 1 piping systems in accordance with ANSI B31.1 standards, which is not addressed in RG 1.46. However, ANSI B31.1 is similar to ASME Code Section III, Class 2 piping; therefore, the applicant used the RG 1.46 Class 2 piping requirements for these lines. Similarly, the applicant states in UFSAR Section 3.6B.2.1.1.1 for Unit 2 that determination of the break locations for ASME Code Section III, Classes 1, 2, and 3 piping systems (outside the scope of those exempted through LBB evaluations as described in LRA Section 4.7.3) is in compliance with RG 1.46.

The applicant also stated that the ANSI B31.1, ASME Code Class 2, and ASME Code Class 3 postulated break locations are determined based on where the maximum stress range derived from the piping stress analysis from normal, upset, and OBE conditions exceeds established criteria. These postulated break location determinations do not use CUFs; therefore, they require no further evaluation for license renewal.

The applicant further stated that for the Unit 2 Class 1 systems, RG 1.46 determines postulated break locations, in part, by using any intermediate locations between terminal ends, where the CUF derived from the piping fatigue analysis under loadings from specified seismic events and operational plant conditions exceeds 0.1. These fatigue evaluations are TLAAs based on a set of fatigue transients for the life of the plant. The cycle assumptions in the fatigue crack growth analyses are conservative compared to the original design cycles. LRA Table 4.3-2 shows the original design-basis transients including RCS design cycles along with the projected operational cycles for 60-years of plant life. The applicant has compared the design cycles to the 60-year projected operational cycles and has determined that the design cycles are bounding for the period of extended operation. The applicant concluded that based on its determination that the fatigue crack growth analyses remain valid for 60-years using the 60-year projected operational cycles, the Metal Fatigue of Reactor Coolant Pressure Boundary Program must continue to validate the assumptions in the evaluation. Therefore, the applicant concluded that the piping fatigue analyses for determining postulated break locations in Class 1 lines remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(iii).

4.7.4.2 Staff Evaluation

The staff reviewed LRA Section 4.7.4 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In LRA Section 4.7.4, the staff reviewed the applicant's technical information and onsite documentation supporting the applicant's conclusion that the analysis postulation of the HELB remains valid for the period of extended operation. The staff also interviewed the applicant's technical staff to verify the description of the LRA and its supplementing documents.

The staff noted the criteria for protection against dynamic effects associated with a major pipe rupture is described in UFSAR Section 5.2.6.3 for Unit 1. The staff further noted that the piping in Unit 1 was designed in accordance with the ANSI B31.1 code. For such piping, postulated break locations is dependent, in part, on the maximum stress range associated with normal and upset conditions and an OBE event derived from the piping stress analysis, and are not dependent on CUFs. The staff further noted that the Unit 1 HELB postulation for license renewal does not meet the definition of a TLAA as described in 10 CFR 54.3(a); therefore, a TLAA evaluation is not required.

For Unit 2, the design basis of HELB postulation is provided in UFSAR Section 3.6.

The staff noted in the description in LRA Section 4.7.4 the applicant stated, "The cycle assumptions used in the fatigue crack growth analyses are conservative compared to the BVPS original design cycles," and "Since the 60-year projected operational cycles were used in determining that fatigue crack growth analyses remains valid for 60 years, the Metal Fatigue of Reactor Pressure Boundary Program must continue to be used to validate the assumptions used in the evaluations." In RAI 4.7.4-1 dated May 28, 2008, the staff requested that the applicant explain the reason why fatigue crack growth analyses are evaluated for the HELB postulation TLAA**.**

In its response to RAI 4.7.4-1, dated July 11, 2008, the applicant stated that use of the term "fatigue crack growth analyses" was a typographical error. Therefore the applicant amended LRA Section 4.7.4 to use the correct terminology, "fatigue analyses." The staff concludes that the applicant's amendment uses the correct terminology of "fatigue analyses", as opposed to "fatigue crack growth analyses." Therefore, the staff's concern described in RAI 4.7.4-1 is resolved.

The staff noted in LRA Section 4.7.4 that the applicant utilized the projected operational cycles expected to occur in 60 years of operation. The applicant compared the projected cycles with the design cycles and determined that the design cycles are bounding. During its review, the staff noted that additional clarification was required for the Class 1 high-energy piping. In RAI 4.7.4-2, dated May 28, 2008, staff requested that the applicant confirm whether any Class 1 high-energy piping locations with a CUF of less than 0.1 by the CLB may exceed the 0.1 CUF during the period of extended operation.

In its response to RAI 4.7.4-2, dated July 11, 2008, the applicant stated that the design CUF for Class 1 high-energy piping locations has not increased; therefore, there are no locations where the design CUF had been less than 0.1 or will be greater than 0.1.

Based on its review, the staff finds the applicant's response acceptable because the applicant has confirmed that there are no new rupture locations that are postulated, the staff finds the applicant's response to RAI 4.4.7-2 acceptable. Therefore, the staff's concern described in RAI 4.4.7-2 is resolved.

Based on its review and the applicant's confirmation as described above, the staff determines that the design CUF is bounding for the period of extended operation and the applicant has demonstrated the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). Since the applicant has utilized the 60-year projected operational cycles in determining the fatigue analyses remains valid for the period of extended operation, the applicant's Metal Fatigue of Reactor Coolant Pressure Boundary Program must validate the assumptions in these evaluations. Therefore the staff finds that the effects of aging on the intended functions will be adequately managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.4.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of HELB postulation in LRA Section A.3.6.2. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address HELB postulation is adequate.

4.7.4.4 Conclusion

Based on its review as discussed above, the staff concludes that the applicant has provided an acceptable demonstration that the postulated break location in Class 1 lines for Unit 1 does not meet the definition of a TLAA in accordance with 10 CFR 54.3(a). The staff further concludes that the applicant has provided an acceptable demonstration for HELB TLAA for Unit 2, and pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation and, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also reviewed the UFSAR supplement for this TLAA and concludes that it provides an adequate summary description of the HELB TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.5 Settlement of Structures (Unit 2 Only)

4.7.5.1 Summary of Technical Information in the Application

In LRA Section 4.7.5, the applicant stated that settlement of Unit 2 Category I structures and buried piping is documented in UFSAR Section 2.5.4.13. The applicant's general analysis and evaluation of structural settlement is documented in UFSAR Section 2.5.4.10.2. The applicant monitored the settlement of the structures and buried piping during construction and will continue to do so throughout the life of the plant, until it determines that the settlement for a particular structure is stable; after which, it will discontinue monitoring. The applicant determined the stability of settling structures for Unit 2 pursuant to the Settlement Monitoring Program (Unit 2 only) description in LRA Section B.2.37. This program provides the requirements to measure the settlement of Unit 2 structures at selected locations. If the measured settlements of a structure exceed the expected settlements, the applicant stated that it will review the current settlement analysis as it relates to the integrity of the structure and the maintenance of settlement assumptions made in the piping stress analyses.

The applicant also stated that the Settlement Monitoring Program (Unit 2 only) ensures that the current 40-year settlement assumptions in the Unit 2 buried piping stress analyses are maintained for the period of extended operation. Therefore, the Unit 2 piping fatigue TLAAs have been disposition in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.5.2 Staff Evaluation

The staff reviewed LRA Section 4.7.5 to verify pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The staff reviewed LRA Section 4.7.5 for Unit 2 for correlation with the provisions in UFSAR Section 2.5.4.10.2 and determined that additional information was needed to complete its review.

In RAI 4.7.5-1, dated April 1, 2008, the staff requested that the applicant indicate, for each structure included in the Settlement Monitoring Program, whether the structure is currently being monitored and if it will be monitored to the end of the period of extended operation.
In its response to RAI 4.7.5-1, dated April 30, 2008, the applicant stated that it monitors all Unit 2 structures under the Settlement Monitoring Program (Unit 2 only) to the end of the period of extended operation. Each Category I structure in the program has been monitored since plant construction and will be monitored throughout the life of the plant, until its settlement stability has been determined. Settlement monitoring will be discontinued for structures that meet the criteria for stability.

The applicant further stated that settlement is measured by markers placed in the vicinity of the structures. A marker is considered stable if a trend can be established over a reasonable time frame (two to three years) that shows the marker has achieved and maintained a “fixed” elevation within a tolerance of plus or minus 1/8 inch. The applicant noted that all Unit 2 safety-related structures were determined to be stable with the exception of the following three locations: (1) refueling water storage tank pad and shield wall; (2) safeguards area building; and (3) valve pit. The applicant stated that it will continue to monitor these structures until a fixed elevation is achieved, pursuant to the Settlement Monitoring Program (Unit 2 only).

The staff finds the applicant’s response to RAI 4.7.5-1 acceptable because it conforms to current industry practice. Therefore, the staff’s concern described in RAI 4.7.5-1 is resolved.

In RAI 4.7.5-2, dated April 1, 2008, the staff requested that the applicant provide a list of safety-related piping systems that are subject to differential settlement of the attached structures. For each system, the staff requested the projected 40-year and 60-year differential settlement of the anchor points, and the highest projected stresses for 60-year operation.

In its response, dated April 30, 2008, the applicant stated that no safety-related piping is monitored for differential settlement under the Settlement Monitoring Program (Unit 2 only), as described in UFSAR Section 2.5.4.13 for Unit 2. The applicant went on to state that if the settlements at selected locations of a Unit 2 structure exceed the anticipated settlements, it will review the current analysis as it relates to the integrity of the structure and the assumed settlements in the associated piping stress analyses, in accordance with the provisions of the Settlement Monitoring Program (Unit 2 only).

The staff reviewed the applicant's response to RAI 4.7.5-2 and finds it acceptable, because the integrity of safety-related structures and safety-related piping in Unit 2 is based on provisions of the Settlement Monitoring Program (Unit 2 only) which was previously accepted by the staff. Therefore, the staff's concern described in RAI 4.7.5-2 is resolved.

In RAI 4.7.5-3, dated April 1, 2008, the staff requested that the applicant list the Unit 2 structures that were initially monitored under the Settlement Monitoring Program (Unit 2 only) and are no longer monitored, and provide the basis for removing these structures from the monitoring program.

In its response to RAI 4.7.5-3, dated April 30, 2008, the applicant stated that the following safety-related structures were judged to have achieved settlement stability, by meeting the criterion that marker elevation remain within a plus or minus tolerance band of 0.125 inches for a period of two to three years: (1) auxiliary building; (2) diesel generator building; (3) emergency outfall structure; (4) fuel and decontamination building; (5) primary plant demineralized water tank pad and enclosure; (6) reactor containment building; (7) Unit 2 control room extension; (8) service building; (9) main steam and cable vault; and (10) intake structure. The applicant stated that it had discontinued monitoring of these buildings once it had determined that the settlement markers were stable.

The staff finds the applicant's response to RAI 4.7.5-3 acceptable because the applicant has demonstrated that settlement of the previously identified structures has stabilized, and has provided justification for discontinuing of monitoring of these structures for the period of extended operation. Therefore, the staff's concern described in RAI 4.7.5-3 is resolved.

The last sentence of LRA Section 4.7.5 indicates that the Unit 2 piping fatigue TLAAs have been disposition in accordance with 10 CFR 54.21 (c)(1)(iii). In RAI 4.7.5-4, dated April 1, 2008, the staff requested that the applicant identify the fatigue effects on the buried piping associated with piping settlement, and to clarify how the piping fatigue TLAA for the buried piping was dispositioned.

In its response to RAI 4.7.5-4, dated April 30, 2008, the applicant stated that the use of the term "fatigue" was incorrect, as there is no fatigue associated with buried piping. The term stress should have been used instead of the term "fatigue." The last sentence should have read: "Therefore, the TLAAs associated with the Unit 2 piping stress analysis have been dispositioned in accordance with 10 CFR 50.54 (c)(1)(iii)." The applicant has submitted Amendment 7 to revise LRA Section 4.7.5.

The staff finds the applicant's response to RAI 4.7.5.-4 acceptable because the applicant clarified the language in the last sentence in LRA Section 4.7.5 and submitted a revision (Amendment 7). Therefore, the staff's concern described in RAI 4.7.5-4 is resolved.

4.7.5.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA of settlement of structures for Unit 2 in LRA Section A.3.6.3.

By letter dated April 30, 2008, the applicant revised this Section of the supplement to state that "the TLAAs associated with the Unit 2 piping stress analysis have been dispositioned in accordance with 10 CFR 50.54 (c)(1)(iii).” The staff finds this acceptable since this statement corresponds to the revision to LRA Section 4.7.5, as discussed in the applicant’s response to RAI 4.7.5-4.

Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant’s actions to address the Unit 2 settlement of structures is adequate.

4.7.5.4 Conclusion

The staff has reviewed the applicant’s submittal, in accordance with SRP-LR Section 4.7.3.1 and finds that the settlement AMP provides assurance that the provisions of UFSAR Section 2.5.4.10.2 will be extended to the end of the period of extended operation. The staff concludes that the applicant’s commitment to continue monitoring the effects of Category I structure settlement on buried piping attached to these structures will provide assurance that the stresses in buried pipes resulting from the differential settlement of the attached Category I buildings will not be exceeded for the life of the plant.

Based on its review, the staff concludes that, pursuant to 10 CFR 54.21(c)(1)(iii), the applicant has demonstrated that for the Unit 2 Settlement TLAA, the effects of aging on the intended function(s) of the attached buried piping will be adequately managed for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of this TLAA evaluation for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(d).

4.7.6 Crane Load Cycles

4.7.6.1 Summary of Technical Information in the Application

In LRA Section 4.7.6, the applicant summarized its evaluation of crane load cycles for the period of extended operation. Generic Letter (GL) 80-113, “Control of Heavy Loads,” requests that all licensees of operating plants review their controls for handling heavy loads for the extent to which these controls satisfy the guidelines of NUREG-0612, “Control of Heavy Loads at Nuclear Power Plants,” and for changes and modifications required to fully satisfy the guidelines. NUREG-0612 requires verification that crane designs comply with the guidelines of Crane Manufacturers Association of America Specification #70 (CMAA-70), “Specifications for Electric Overhead Traveling Cranes,” and ANSI B30.2-1976, Chapter 2-1, “Overhead and Gantry Cranes,” and a demonstration of equivalency of actual design requirements not in specific compliance with these standards. CMAA-70 Section 3.4.8 requires the crane design determination of allowable stress range for repeated loads. Allowable stress range is based on service class and joint category. The service class is based on a calculation of mean effective load factor (includes load magnitude and load probability), load classes, and load cycles. The minimum number of CMAA-70 load cycles is 20,000 for Class A cranes with a mean effective load factor range of 0.35-0.53. The service class load cycle parameter is based on the estimated number of load cycles (crane lifts) over the service life of the component and is, therefore, a TLAA in accordance with 10 CFR 54.3.

The staff's review of the Unit 1 response to GL 80-113 was published by the NRC in a technical evaluation report, "Control of Heavy Loads." As stated in the report, the following two Unit 1 cranes are designed to CMAA-70 standards and require TLAAs:

- Fuel cask crane (CR-15); and,
- Moveable platform and hoists crane (CR-27).

The applicant, in its September 21, 1981 response to the guidance in NUREG-0612 and GL 80-113, determined that the following three Unit 2 cranes are designed to CMAA-70 standards and require TLAAs:

- Polar crane (CRN201);
- Spent fuel cask trolley (CRN215); and,
- Moveable platform with hoists crane (CRN227).

The applicant stated that the two Unit 1 and the three Unit 2 cranes may be conservatively classified as Service Class A cranes. Conservatively estimated total load cycles and mean effective load factors for the five cranes for the period of extended operation are well below 20,000, with mean effective load factors maintained within Service Class A bounds (0.35 - 0.53) for 60 years. The applicant therefore concluded that the crane allowable stress ranges pursuant to CMAA-70 will remain valid through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7.6.2 Staff Evaluation

The staff reviewed LRA Section 4.7.6 to verify, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation.

In LRA Section 4.7.6, the applicant stated that total load cycles are well below 20,000 and mean effective load factors are maintained within or below the Service Class A bounds (0.35 - 0.53) for 60 years. However, the applicant did not provide any information on how the load cycles were calculated to conclude that the stress ranges remain valid through the period of extended operation. In RAI 4.7.6-1, dated May 22, 2008, the staff requested that the applicant provide the projected number of cycles calculated for 60 years for each of these cranes.

In its response to RAI 4.7.6-1, dated July 24, 2008, the applicant provided the following information in a table showing the 60-year projected crane cycles and how they were calculated. The applicant assumed 36 and 39 projected RFOs for Units 1 and 2, respectively.

The Unit 1 spent fuel cask crane, rated for 125 tons, is used to lift spent fuel shipping cask weighing 21.5 tons. At 2.1 lifts per outage, the projected number of cycles is 75. The staff concurs with the applicant's estimate of 75 cycles and finds it to be less than the CMAA 70 limit of 20,000 cycles by several orders of magnitude. Therefore, the staff finds that the Unit 1 spent fuel cask crane was adequately evaluated for the period of extended operation.

The Unit 1 moveable platform and hoists cranes, rated for 5 tons each, are used for fuel assembly movements weighing 2.5 tons each. The applicant calculated 502 lifts per outage based on full core offload and onload, with additional fuel assembly reshuffles and new fuel assemblies. The projected cycles based on 502 lifts are about 18,150. The staff concurs with this estimate and finds it to be less than the CMAA 70 limit of 20,000 cycles. Therefore, the staff finds that the Unit 1 moveable platform and hoists cranes were adequately evaluated for the period of extended operation.

The Unit 2 polar crane, rated for 167 tons is used to lift RV head and attachment weighing 134 tons, and other equipment weighing significantly less. The projected cycles was calculated at 2,088. The staff concurs with the applicant's estimate of 2,088 cycles and finds it to be less than the CMAA 70 limit of 20,000 cycles by several orders of magnitude. Therefore, the staff finds that the Unit 2 polar crane was adequately evaluated for the period of extended operation.

The Unit 2 spent fuel cask trolley, rated for 125 tons, is used to lift spent fuel shipping cart weighing 100 tons. The projected cycles was calculated at 206. The staff concurs with the applicant's estimate of 206 cycles and finds it to be less than the CMAA 70 limit of 20,000 cycles by several orders of magnitude. Therefore, the staff finds that the Unit 2 spent fuel cask trolley was adequately evaluated for the period of extended operation.
The Unit 2 moveable platform and hoists cranes, rated for 10 tons each, are used for fuel assembly movements weighing 3 tons each. The applicant calculated 502 lifts per outage based on full core offload and onload, with additional fuel assembly reshuffles and new fuel assemblies. The projected cycles based on 502 lifts are about 19,800. The staff concurs with this estimate and finds it to be less than the CMAA 70 limit of 20,000 cycles. Although the number of cycles is very close to the CMAA 70 limit, the load lifted is 30% of the rated capacity of the cranes.

Therefore, the staff finds that the Unit 2 moveable platform and hoists cranes were adequately evaluated for the period of extended operation.

The staff finds the applicant's response to RAI 4.7.6-1 acceptable because the applicant has provided the requested crane load cycle calculations that adequately demonstrate that the crane load stress ranges remain valid through the period of extended operation. Therefore, the staff's concern described in RAI 4.7.6-1 is resolved.

4.7.6.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of crane load cycles in LRA Sections A.2.6.4 and A.3.6.4. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address crane load cycles is adequate.

4.7.6.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that, for crane load cycles, the analyses remain valid for the period of extended operation.

The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.8 Conclusion for TLAAs

The staff reviewed the information in LRA Section 4, "Time-Limited Aging Analyses." Based on its review, the staff concludes that the applicant has provided a sufficient list of TLAAs, as defined in 10 CFR 54.3 and that the applicant has demonstrated that: (1) the TLAAs will remain valid for the period of extended operation, as required by 10 CFR 54.21(c)(1)(i); (2) the TLAAs have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii); or (3) that the effects of aging on intended function(s) will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). The staff also reviewed the UFSAR supplement for the TLAAs and finds that the supplement contains descriptions of the TLAAs sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes, as required by 10 CFR 54.21(c)(2) that no plant-specific, TLAA-based exemptions are in effect.

With regard to these matters, the staff concludes that there is reasonable assurance that the activities authorized by the renewed licenses will continue to be conducted in accordance with the CLB, and that any changes made to the CLB, 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 Beaver Valley Power Station, Units 1 and 2. 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, Inc. (the applicant) and the staff of the United States 9US) Nuclear Regulatory Commission (NRC) (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.

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SECTION 6

CONCLUSION

The staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff) reviewed the license renewal application (LRA) for Beaver Valley Power Station, Units 1 and 2, in accordance with NRC regulations and NUREG-1800, Revision 1, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” dated September 2005. Title 10, Section 54.29, of the *Code of Federal Regulations* (10 CFR 54.29) sets the standards for issuance of a renewed license.

On the basis of its review of the LRA, the staff concludes that the requirements of 10 CFR 54.29(a) have been met.

The staff noted that any requirements of 10 CFR Part 51, Subpart A, are documented in NUREG-1437, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)” and Supplement 36, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Beaver Valley Power Station Units 1 and 2,” dated May 14, 2009.

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APPENDIX A

BVPS UNITS 1 AND 2 LICENSE RENEWAL COMMITMENTS

During the review of the Beaver Valley Power Station (BVPS), Units 1 and 2, license renewal application (LRA) by the staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff), FirstEnergy Nuclear Operating Company (the applicant) made commitments related to aging management programs (AMPs) to manage aging effects for structures and components. The following table lists these commitments along with the implementation schedules and sources for each commitment.

BVPS UNIT 1 LICENSE RENEWAL COMMITMENTS

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
1	Implement the Buried Piping and Tanks Inspection Program as described in LRA Section B.2.8.	A.1.8 B.2.8	Will be implemented within the 10 years prior to January 29, 2016	LRA
2	Enhance the Closed-Cycle Cooling Water System Program to: • Add the diesel-driven fire pump (Unit 1 only) to the program; • Detail performance testing of heat exchangers and pumps, and provide direction to perform visual inspections of system components; • Identify closed-cycle cooling water system parameters that will be trended to determine if heat exchanger tube fouling or corrosion product buildup exists; • Control performance tests and perform visual inspections at the required frequency.	A.1.9 B.2.9	January 29, 2016	LRA
3	Implement the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program as described in LRA Section B.2.10. Prior to implementation of the program, evaluate the program against the final approved version of NRC License Renewal Interim Staff Guidance LR-ISG- 2007-02, "Changes To Generic Aging Lesson Learned (GALL) Report Aging Management Program (AMP) XI.E6, "Electrical Cable Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements, “" when issued, and revise the program to be consistent with the NRC Interim Staff Guidance.	A.1.10 B.2.10	Will be implemented within the 10 years prior to January 29, 2016	FENOC Letter L-08-262
4	Implement the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as described in LRA Section B.2.11.	A.1.11 B.2.11	January 29, 2016	LRA

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
5	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.2.12.	A.1.12 B.2.12	January 29, 2016	LRA
6	Implement the External Surfaces Monitoring Program as described in LRA Section B.2.15.	A.1.15 B.2.15	January 29, 2016 LRA	LRA
7	Enhance the Fire Protection Program to: • Include a new attachment in the BVPS Fire Protection Program administrative procedure to address the Fire Protection Systems that are in scope for license renewal purposes; • Provide details of the NUREG-1801 inspection and testing guidelines, the plant implementation strategy, surveillance test and inspection frequencies (inspection frequency of the Halon and CO_2 systems will be changed to at least once every 6 months), and affected implementing procedure(s); and, • Provide inspection guidance details to include degradation such as concrete cracking and spalling, and loss of material of fire barrier walls, ceilings and floors that may affect the fire rating of the assembly or barrier.	A.1.16 B.2.16	January 29, 2016	LRA and FENOC Letter L-08-375

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
8	Enhance the Fire Water System Program to: • Include a program requirement to perform flow test or inspection of all accessible fire water headers and piping during the period of extended operation at an interval determined by the Fire Protection System Engineer; • Include a program requirement that a representative number of fire water piping locations be identified if piping visual inspections are used as an alternative to non-intrusive testing; • Include a program requirement which allows test or inspection results from an accessible Section of pipe to be extrapolated to an inaccessible, but similar Section of pipe. If no similar Section of accessible pipe is available, then alternative testing or inspection activities must be used; • Include a program requirement that, at least once prior to the period of extended operation, all accessible Fire Protection headers and piping shall be flow tested in accordance with NFPA 25 or visually/ultrasonically inspected; • Include steps in the program procedure that require testing or replacement of sprinkler heads that will have been in service for 50 years; and, • Include a program requirement to perform a fire water subsystem internal inspection any time a subsystem (including fire pumps) is breached for repair or maintenance.	A.1.17 B.2.17	Will be implemented within the 10 years prior to January 29, 2016	LRA
9	Enhance the Flux Thimble Tube Inspection Program to: • Include a requirement in the program procedure to state that, if a flux thimble tube cannot be inspected over the tube length (tube length that is subject to wear due to restriction or other defect), and cannot be shown by analysis to be satisfactory for continued service, the thimble tube must be removed from service to ensure the integrity of the Reactor Coolant System pressure boundary.	A.1.19 B.2.19	January 29, 2016	LRA

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
10	Enhance the Fuel Oil Chemistry Program to: • Revise the implementing procedure for sampling and testing the diesel-driven fire pump fuel oil storage tank (Unit 1 only) to include a test for particulate and accumulated water in addition to the test for sediment and water; • Generate a new implementing procedure for sampling and testing the security diesel generator fuel oil day tank (Common) for accumulated water, particulate contamination, and sediment/water; and, • Revise implementing procedures to perform UT thickness measurements of accessible above-ground fuel oil tank bottoms at the same frequency as tank cleaning and inspections to ensure that significant degradation is not occurring. For inaccessible tank bottoms, determine tank bottom thickness using an appropriate NDE technique if inspections indicate the presence of significant corrosion.	A.1.20 B.2.20	January 29, 2016	FENOC Letter L-08-316

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
11	Implement the Inaccessible Medium-Voltage Cables Suitable for Submergence and Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as described in LRA Section B.2.21. BVPS commits to implement one of the following prior to entering the period of extended operation: 1. Adopt an acceptable methodology that demonstrates that the in-scope, continuously submerged, inaccessible, medium-voltage cables will continue to perform their intended function during the period of extended operation. -or- 2. Implement measures to minimize cable exposure to significant moisture through dewatering manholes. Incorporate operating experience obtained from dewatering frequency to minimize cable exposure to significant moisture. [Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant.] -or- 3. Replace the in-scope, continuously submerged medium-voltage cables with cables designed for submerged service.	A.1.21 B.2.21	January 29, 2016	LRA; FENOC Letter L-08-262; FENOC Letter L-09-057; FENOC Letter L-09-138; and FENOC Letter L-09-151
12	Implement the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program as described in LRA Section B.2.22.	A.1.22 B.2.22	January 29, 2016	LRA
13	Enhance the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program to: • Include guidance in the program administrative procedure to inspect for loss of material due to corrosion on Unit 1 crane and trolley structural components and rails; and, • Include guidance in the crane and hoist inspection procedures to inspect for loss of material due to corrosion on Unit 1 crane and trolley structural components and rails or extendable arms, as appropriate.	A.1.23 B.2.23	January 29, 2016	LRA

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
14	Enhance the Masonry Wall Program to: • Include in program scope additional masonry walls identified as having aging effects requiring management for license renewal; and, • Include a requirement in program procedures to incorporate the results of the Masonry Wall Program inspection and document the condition of the walls in the inspection report.	A.1.25 B.2.25	January 29, 2016	FENOC Letter L-08-262
15	Regarding activities for managing the aging of nickel-alloy components and nickel-alloy clad components susceptible to primary water stress corrosion cracking - PWSCC (other than upper reactor vessel closure head nozzles and penetrations), BVPS commits to develop a plant-specific aging management program that will implement applicable: 1. NRC Orders, Bulletins and Generic 2. Letters; and, Staff-accepted industry guidelines.	NONE	January 29, 2016	FENOC Letter L-08-212
16	Implement the One-Time Inspection Program as described in LRA Section B.2.30.	A.1.30 B.2.30	Will be implemented within the 10 years prior to January 29, 2016	LRA
17	Implement the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program as described in LRA Section B.2.31.	A.1.31 B.2.31	Will be implemented within the 10 years prior to January 29, 2016	LRA
18	Regarding activities for managing the aging of Reactor Vessel internal components and structures, BVPS commits to: 1. Participate in the industry programs applicable to BVPS Unit 1 for investigating and managing aging effects on reactor internals; 2. Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 1 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 the BVPS Unit 1 reactor internals to the NRC for review and approval.	NONE	January 29, 2014	FENOC Letter L-08-212
19	Implement the Selective Leaching of Materials Program as described in LRA Section B.2.36.	A.1.36 B.2.36	January 29, 2016	LRA

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
20	Enhance the Structures Monitoring Program to: • Include in program scope additional structures and structural components identified as having aging effects requiring management for license renewal; • Include inspection guidance in program implementing procedures to detect significant cracking in concrete surrounding the anchors of vibrating equipment; • Include a requirement in program procedures to perform opportunistic inspections of normally inaccessible below-grade concrete when excavation work uncovers a significant depth; • Include a requirement in program procedures to perform periodic sampling of groundwater for pH, chloride concentration, and sulfate concentration; and, • Include a requirement in program procedures to monitor elastomeric materials used in seals and sealants, including compressible joints and seals, waterproofing membranes, etc., associated with in-scope structures and structural components for cracking and change in material properties; • Include a requirement in program procedures to perform specific measurements and/or characterizations of structural deficiencies, based on the results of previous inspections and guidance from AC! 349.3R-96, Section 5.1.1, and ACI 201.1 68; • Include a requirement in program procedures to document in the program inspection report a comparison of the results of the program inspections with the results of the previous program inspection; • Include a requirement in program procedures to file the Structures Monitoring Program inspection reports in the BVPS document control system so that inspection results can be more effectively monitored; • Include a requirement in program procedures to apply inspection acceptance criteria based on the results of past inspections and guidance from ACI 349.3R-96, Section 5.1.1. and ACI 201.1-68; and, • Include a requirement in program procedures that noted deficiencies will be reported using the Corrective Action Program.	A.1.39 B.2.39	January 29, 2016 for all enhancements except groundwater sampling (4th bullet). Groundwater sampling will be implemented five (5) years prior to entering the period of extended operation, then continue on a five (5) year interval thereafter.	FENOC Letter L-08-262

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
21	With the exception of flexible connections in ventilations systems, prior to the period of extended operation, FENOC will perform repetitive maintenance tasks to replace mechanical system elastomeric components that would otherwise be subject to aging management review. Subsequent frequencies of the repetitive replacements will be based on manufacturer recommendations and applicable operating experience.	NONE	January 29, 2016	FENOC Letter L-08-212
22	Implement the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program as described in LRA Section B.2.41.	A.1.41 B.2.41	January 29, 2016	LRA
23	Enhance the Water Chemistry Program to: • Change BVPS frequency for reactor coolant silica monitoring to once per week for Operational Modes 1 and 2, and once per day during heatup in Operational Modes 3 and 4 to be consistent with EPRI guidelines.	A.1.42 B.2.42	January 29, 2016	LRA
24	Prior to exceeding the PTS screening criteria for BVPS Unit 1, FENOC will select a flux reduction measure to manage PTS in accordance with the requirements of 10 CFR 50.61. A flux reduction plan submitted for NRC review and approval.	A.2.2.2 4.2.2	A flux reduction plan will be submitted at least 1 year prior to the implementation of the flux reduction measure.	FENOC Letter L-08-124

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
25	Enhance the Metal Fatigue of the Reactor Coolant Pressure Boundary Program to: • Add a requirement that fatigue will be managed for the NUREG/CR-6260 locations. This requirement will provide that management is accomplished by one or more of the following: 1. Further refinement of the fatigue analyses to lower the predicted CUFs to less than 1.0; 2. Management of fatigue at the affected locations by an inspection program that has been 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); or, 3. Repair or replacement of the affected locations. • Add a requirement that provides for monitoring of the Unit 1 RHR activation transient and establishes an administration limit of 600 cycles for the transient. • Add a requirement to monitor Unit 1 transients where the 60 year projected cycles are used in the environmental fatigue evaluations, and establish an administration limit that is equal to or less than the 60-year projected cycles number.	B.2.27	January 29, 2016	FENOC Letter L-08-209
26	Evaluate Unit 1 Extended Power Uprate operating experience prior to the period of extended operation for license renewal aging management program adjustments.	Appendix B.2	January 29, 2016	LRA
27	As part of the Reactor Vessel Integrity Program, FENOC will store and maintain Unit 1standby surveillance capsules in a condition that would permit their future use through the end of the period of extended operation.	B.2.35	Within 30 days following receipt of renewed license	FENOC Letter L-08-143
28	With the exception of underground GeoFlex® fuel oil piping, prior to the period of extended operation, FENOC will perform repetitive maintenance tasks to replace, or to test and replace on condition, mechanical system polymer components that would otherwise be subject to aging management review. Subsequent frequencies of the repetitive tests/replacements will be based on manufacturer recommendations and applicable operating experience.	NONE	January 29, 2016	FENOC Letter L-08-212

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
29	Confirm the effectiveness of the new license renewal aging management programs based on the incorporation of operating experience by performing a program self assessment of all new license renewal aging management programs. [See NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, "Appendix A, "Branch Technical Positions," Section A. 1.2.3.10, Items 1 and 2.]	B.2.8 B.2.10 B. 2.11 B. 2.12 B. 2.15 B. 2.21 B. 2.22 B. 2.30 B. 2.31 B. 2.36 B.2.41	January 29, 2021	FENOC Letter L-08-226
30	Enhance the Open-Cycle Cooling Water System Program to: • Include in program scope the Post-Accident Sample System heat exchanger (PAS-E-1) credited with a leakage boundary function; and, • Assess the internal condition of buried piping by opportunistic inspections of header piping internals during removal of expansion joints and inline valves in the headers. Evaluation of inspection results will be documented and trended.	A. 1.32 B. 2.32	January 29, 2016	FENOC Letter L-08-262
31	Implement "needed actions" of MRP-146. These actions include screening, detailed analysis, inspections and temperature monitoring in accordance with the guidelines of MRP-146. FENOC has completed screening of the BVPS RCS branch lines.	NONE	FENOC will perform detailed evaluations (analysis, inspections and/or monitoring) in accordance with MRP-146 schedule requirements, or as established by the MRP committee.	FENOC Letter L-08-287
32	Supplemental volumetric examinations will be performed on the Unit 1 containment liner prior to the period of extended operation. Seventy five (one foot square) sample locations will be examined. If degradation is identified, the degraded area(s) will be evaluated and follow-up examinations will be performed to ensure the continued reliability of the containment liner.	None	January 29, 2016	FENOC Letter L-090139

BVPS UNIT 2 LICENSE RENEWAL COMMITMENTS

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
1	Implement the Buried Piping and Tanks Inspection Program as described in LRA Section B.2.8. Will be implemented within the 10 years prior to May 27, 2027 LRA A.1.8 B.2.8	A.1.8 B.2.8	Will be implemented within the 10 years prior to May 27, 2027	LRA
2	Enhance the Closed-Cycle Cooling Water System Program to: • Add the diesel-driven fire pump (Unit 1 only) and the diesel-driven standby air compressor (Unit 2 only) to the program; • Detail performance testing of heat exchangers and pumps, and provide direction to perform visual inspections of system components; • Identify closed-cycle cooling water system parameters that will be trended to determine if heat exchanger tube fouling or corrosion product buildup exists; • Control performance tests and perform visual inspections at the required frequency.	A.1.9 B.2.9	May 27, 2027	LRA
3	Implement the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements One-Time Inspection Program as described in LRA Section B.2.10. Prior to implementation of the program, evaluate the program against the final approved version of NRC License Renewal Interim Staff Guidance LR-ISG-2007-02, "Changes To Generic Aging Lesson Learned (GALL) Report Aging Management Program (AMP) XI.E6, "Electrical Cable Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements, "" when issued, and revise the program to be consistent with the NRC Interim Staff Guidance.	A.1.10 B.2.10	Will be implemented within the 10 years prior to May 27, 2027	FENOC Letter L-08-262
4	Implement the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as described in LRA Section B.2.11.	A.1.11 B.2.11	May 27, 2027	LRA
5	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.2.12.	A.1.12 B.2.12	May 27, 2027	LRA
6	Implement the Electrical Wooden Poles/Structures Inspection Program as described in LRA Section B.2.13.	A.1.13 B.2.13	Will be implemented within the 5 years prior to May 27, 2027	LRA
7	Implement the External Surfaces Monitoring Program as described in LRA Section B.2.15.	A.1.15 B.2.15	May 27, 2027	LRA

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
8	Enhance the Fire Protection Program to: • Include a new attachment to the BVPS Fire Protection Program administrative procedure to address the Fire Protection Systems that are in scope for license renewal purposes; • Provide details of the NUREG-1801 inspection and testing guidelines, the plant implementation strategy, surveillance test and inspection frequencies (inspection frequency of the Halon and CO_2 systems will be changed to at least once every 6 months), and affected implementing procedure(s); and, • Provide inspection guidance details to include degradation such as concrete cracking and spalling, and loss of material of fire barrier walls, ceilings and floors that may affect the fire rating of the assembly or barrier.	A.1.16 B.2.16	May 27, 2027	LRA and FENOC Letter L-08-375
9	Enhance the Fire Water System Program to: • Include a program requirement to perform flow test or inspection of all accessible fire water headers and piping during the period of extended operation at an interval determined by the Fire Protection System Engineer; • Include a program requirement that requires a representative number of fire water piping locations be identified if piping visual inspections are used as an alternative to non-intrusive testing; • Include a program requirement that allows test or inspection results from an accessible Section of pipe to be extrapolated to an inaccessible, but similar Section of pipe. If no similar Section of accessible pipe is available, then alternative testing or inspection activities must be used; • Include a program requirement that, at least once prior to the period of extended operation, all accessible Fire Protection headers and piping shall be flow tested in accordance with NFPA 25 or visually/ultrasonically inspected; • Include steps in the program procedure that require testing or replacement of sprinkler heads that will have been in service for 50 years; and, • Include a program requirement to perform a fire water subsystem internal inspection any time a subsystem (including fire pumps) is breached for repair or maintenance.	A.1.17 B.2.17	Will be implemented within the 10 years prior to May 27, 2027	LRA

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
10	Enhance the Flux Thimble Tube Inspection Program to: • Include a requirement in the program procedure to state that, if a flux thimble tube cannot be inspected over the tube length (tube length that is subject to wear due to restriction or other defect), and cannot be shown by analysis to be satisfactory for continued service, the thimble tube must be removed from service to ensure the integrity of the Reactor Coolant System pressure boundary.	A.1.19 B.2.19	May 27, 2027	LRA
11	Enhance the Fuel Oil Chemistry Program to: • Revise the implementing procedure for sampling and testing the diesel-driven fire pump fuel oil storage tank (Unit 1 only) to include a test for particulate and accumulated water in addition to the test for sediment and water; • Generate a new implementing procedure for sampling and testing the security diesel generator fuel oil day tank (Common) for accumulated water, particulate contamination, and sediment/water; and, • Revise implementing procedures to perform UT thickness measurements of accessible above-ground fuel oil tank bottoms at the same frequency as tank cleaning and inspections to ensure that significant degradation is not occurring. For inaccessible tank bottoms, determine tank bottom thickness using an appropriate NDE technique if inspections indicate the presence of significant corrosion.	A.1.20 B.2.20	May 27, 2027	FENOC Letter L-08-316

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
12	Implement the Inaccessible Medium- Voltage Cables Suitable for Submergence and Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program as described in LRA Section B.2.21. BVPS commits to implement one of the following prior to entering the period of extended operation: 1. Adopt an acceptable methodology that demonstrates that the in-scope, continuously submerged, inaccessible, medium-voltage cables will continue to perform their intended function during the period of extended operation. -or- 2. Implement measures to minimize cable exposure to significant moisture through dewatering manholes. Incorporate operating experience obtained from dewatering frequency to minimize cable exposure to significant moisture. [Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant.] -or- 3. Replace the in-scope, continuously submerged medium-voltage cables with cables designed for submerged service.	A.1.21 B.2.21	May 27, 2027	LRA; FENOC Letter L-08-262 FENOC Letter L-09-057; FENOC Letter L-09-138; and FENOC Letter L-09-151
13	Implement the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program as described in LRA Section B.2.22.	A.1.22 B.2.22	May 27, 2027	LRA
14	Enhance the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program to: • Include guidance in the program administrative procedure to inspect for loss of material due to corrosion on Unit 2 crane and trolley structural components and rails; and, Include guidance in the crane and hoist inspection procedures to inspect for loss of material due to corrosion on Unit 2 crane and trolley structural components and rails or extendable arms, as appropriate.	A.1.23 B.2.23	May 27, 2027	LRA

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
15	Enhance the Masonry Wall Program to: • Include in program scope additional masonry walls identified as having aging effects requiring management for license renewal; and, • Include a requirement in program procedures to incorporate the results of the Masonry Wall Program inspection and document the condition of the walls in the inspection report.	A.1.25 B.2.25	May 27, 2027	FENOC Letter L-08-262
16	Implement the Metal Enclosed Bus Program as described in LRA Section B.2.26.	A.1.26 B.2.26	May 27, 2027	LRA
17	Regarding activities for managing the aging of nickel-alloy components and nickel-alloy clad components susceptible to primary water stress corrosion cracking - PWSCC (other than upper reactor vessel closure head nozzles and penetrations), BVPS commits to develop a plant-specific aging management program that will implement applicable: 1. NRC Orders, Bulletins and Generic Letters; and, 2. Staff-accepted industry guidelines.	NONE	May 27, 2027	FENOC Letter L-08-212
18	Implement the One-Time Inspection Program as described in LRA Section B.2.30.	A.1.30 B.2.30	Will be implemented within the 10 years prior to May 27, 2027	LRA
19	Implement the One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program as described in LRA Section B.2.31.	A.1.31 B.2.31	Will be implemented within the 10 years prior to May 27, 2027	LRA
20	Regarding activities for managing the aging of Reactor Vessel internal components and structures, BVPS commits to: 1. Participate in the industry programs applicable to BVPS Unit 2 for investigating and managing aging effects on reactor internals; 2. Evaluate and implement the results of the industry programs as applicable to the BVPS Unit 2 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 the BVPS Unit 2 reactor internals to the NRC for review and approval.	NONE	May 27, 2025	FENOC Letter L-08-212
21	Implement the Selective Leaching of Materials Program as described in LRA Section B.2.36.	A.1.36 B.2.36	May 27, 2027	LRA

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
22	Enhance the Structures Monitoring Program to: • Include in program scope additional structures and structural components identified as having aging effects requiring management for license renewal; • Include inspection guidance in program implementing procedures to detect significant cracking in concrete surrounding the anchors of vibrating equipment; • Include a requirement in program procedures to perform opportunistic inspections of normally inaccessible below-grade concrete when excavation work uncovers a significant depth; • Include a requirement in program procedures to perform periodic sampling of groundwater for pH, chloride concentration, and sulfate concentration; • Include a requirement in program procedures to monitor elastomeric materials used in seals and sealants, including compressible joints and seals, waterproofing membranes, etc., associated with in-scope structures and structural components for cracking and change in material properties; • Include a requirement in program procedures to perform specific measurements and/or characterizations of structural deficiencies, based on the results of previous inspections and guidance from ACI 349.3R-96, Section 5.1.1, and ACI 201.1 68; • Include a requirement in program procedures to document in the program inspection report a comparison of the results of the program inspections with the results of the previous program inspection; • Include a requirement in program Procedures to file the Structures Monitoring Program inspection reports in the BVPS document control system so that inspection results can be more effectively monitored; • Include a requirement in program procedures to apply inspection acceptance criteria based on the results of past inspections and guidance from ACI 349.3R-96, Section 5.1.1, and ACI 201.1-68; and, • Include a requirement in program Procedures that noted deficiencies will be reported using the Corrective Action Program.	A.1.39 B.2.39	May 27, 2027 for all enhancements except groundwater sampling (4th bullet). Groundwater sampling will be implemented five (5) years prior to entering the period of extended operation, then continue on a five (5) year interval thereafter.	FENOC Letter L-08-262

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
23	With the exception of flexible connections in ventilations systems, prior to the period of extended operation, FENOC will perform repetitive maintenance tasks to replace mechanical system elastomeric components that would otherwise be subject to aging management review. Subsequent frequencies of the repetitive replacements will be based on manufacturer recommendations and applicable operating experience.	NONE	May 27, 2027	FENOC Letter L-08-212
24	Implement the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program as described in LRA Section B.2.41.	A.1.41 B.2.41	May 27, 2027	LRA
25	Enhance the Water Chemistry Program to: • Change BVPS frequency for reactor coolant silica monitoring to once per week for Operational Modes 1 and 2, and once per day during heatup in Operational Modes 3 and 4, to be consistent with EPRI guidelines.	A.1.42 B.2.42	May 27, 2027	LRA
26	Enhance the Metal Fatigue of the Reactor Coolant Pressure Boundary Program to: • Add a requirement that fatigue will be managed for the NUREG/CR-6260 locations. This requirement will provide that management is accomplished by one or more of the following: 1. Further refinement of the fatigue analyses to lower the predicted CUFs to less than 1.0; 2. Management of fatigue at the affected locations by an inspection program that has been 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); or, 3. Repair or replacement of the affected locations. • Add a requirement that provides for reanalysis, repair, or replacement of the Unit 2 steam generator secondary manway bolts and the steam generator tubes such that the design bases of these components are not exceeded for the period of extended operation. • Add a requirement to monitor Unit 2 transients where the 60-year projected cycles are used in the environmental fatigue evaluations, and establish an administration limit that is equal to or less than the 60-year projected cycles number.	B.2.27	May 27, 2027	FENOC Letter L-08-209

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
27	With the exception of underground GeoFlex® fuel oil piping, prior to the period of extended operation, FENOC will perform repetitive maintenance tasks to replace, or to test and replace on condition, mechanical system polymer components that would otherwise be subject to aging management review. Subsequent frequencies of the repetitive tests/replacements will be based on manufacturer recommendations and applicable operating experience.	NONE	May 27, 2027	FENOC Letter L-08-212 and FENOC Letter L-08-376
28	Confirm the effectiveness of the new license renewal aging management programs based on the incorporation of operating experience by performing a program self assessment of all new license renewal aging management programs. [See NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, "Appendix A, "Branch Technical Positions," Section A. 1.2.3.10, Items 1 and 2.]	B.2.8 B.2.10 B. 2.11 B. 2.12 B. 2.13 B. 2.15 B. 2.21 B. 2.22 B.2.26 B. 2.30 B. 2.31 B. 2.36 B.2.41	May 27, 2032	FENOC Letter L-08-226
29	Evaluate Unit 2 Extended Power Uprate operating experience prior to the period of extended operation for license renewal aging management program adjustments.	Appendix B.2	May 27, 2027	LRA
30	As part of the Reactor Vessel Integrity Program, BVPS will store and maintain Unit 2 standby surveillance capsules in a condition that would permit their future use through the end of the period of extended operation.	B.2.35	Within 30 days following receipt of renewed license	FENOC LetterL-08-143
31	Enhance the Open-Cycle Cooling Water System Program to: • Assess the internal condition of buried piping by opportunistic inspections of header piping internals during removal of expansion joints and inline valves in the headers. Evaluations of inspection results will be documented and trended.	A. 1.32 B.2.32	May 27, 2027	FENOC LetterL-08-262
32	Implement "needed actions" of MRP-146. These actions include screening, detailed analysis, inspections and temperature monitoring in accordance with the guidelines of MRP-146. FENOC has completed screening of the BVPS RCS branch lines.	NONE	FENOC will perform detailed evaluations (analysis, inspections and/or monitoring) in accordance with MRP-146 schedule requirements, or as established by the MRP committee.	FENOC Letter L-08-287

Item Number	Commitment	UFSAR Supplement Section/LRA Section	Enhancement or Implementation Schedule	Source
33	Supplemental volumetric examinations will be performed on the Unit 2 containment liner prior to the period of extended operation. Seventy five (one foot square) sample locations will be examined. If degradation is identified, the degraded area(s) will be evaluated and follow-up examinations will be performed to ensure the continued reliability of the containment liner.	None	May 27, 2027	FENOC Letter L-09-139

APPENDIX B

CHRONOLOGY

This appendix lists chronologically the routine licensing correspondence between the staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff) and FirstEnergy Nuclear Operating Company (FENOC). This appendix also lists other correspondence on the staff's review of the Beaver Valley Power Station (BVPS), Units 1 and 2 license renewal application (LRA) (under Docket Nos. 50-334 and 50-412).

Date	Accession No.	Subject
March 3, 2003	ML030660587	FENOC Letter No. L-03-035, Beaver Valley Power Station, Unit No. 1 and No. 2, BV-1 Docket No. 50-334, License No. DPR-66, BV-2 Docket No. 50-412, License No. NPF-73, Order Establishing Interim Inspection Requirements for RPV Heads.
March 27, 2003	ML030910021	FENOC Letter No. L-03-053, Beaver Valley Power Station, Unit No. 1 and No. 2, BV-1 Docket No. 50-334, License No. DPR-66, BV-2 Docket No. 50-412, License No. NPF-73, Order (EA-03-009) Relaxation Request.
April 1, 2003	ML030900628	NRC Request for Additional Information, "Beaver Valley Power Station, Unit 1 – Request for Additional Information – Request for Relaxation of Order EA-03-009 (TAC MB8174)"
April 2, 2003	ML030970094	FENOC Letter No. L-03-057, Beaver Valley Power Station, Unit No. 1, BV-1 Docket No. 50-334, License No. DPR-66, Reply to Request for Additional Information Regarding Order EA-03-009 Relaxation Request.
April 7, 2003	ML030970856	NRC Safety Evaluation, "Safety Evaluation for Beaver Valley Unit 1, (Order EA-03-009) Relaxation Request, Examination Coverage for Reactor Pressure Vessel Head Penetration Nozzles (TAC MB8174)."
March 5, 2004	ML040690037	FENOC Letter No. L-04-030, Beaver Valley Power Station, Unit No. 1 and No. 2 BV-1 Docket No. 50-334, License No. DPR-66, BV-2 Docket No. 50-412, License No. NPF-73, Response to First Revised Order (EA-03-009)
April 4, 2004	ML040220181	First Revised NRC Order EA-03-009, "Issuance of First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at PWRs"
July 10, 2007	ML071800242	Meeting Notice from S. Hoffman to R. Auluck, "FORTHCOMING MEETING WITH FIRSTENERGY NUCLEAR OPERATING COMPANY REGARDING THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION"
July 31, 2007	ML072150044	Letter from P. Sena III to NRC DCD, "Service List Revision for the Beaver Valley Power Station"
August 2, 2007	ML072220388	(PA-LR) Beaver valley Power Station License Renewal Project Presentation to NRC August 2, 2007

Date	Accession No.	Subject
August 2, 2007	ML072250023	(PA-LR) Beaver valley Power Station License Renewal Project Presentation to NRC August 2, 2007, Meeting Handouts
August 27, 2007	ML072410030	Letter from P. Sena III to DCD, “Beaver Valley Power Station, Unit Nos. 1 and 2 BV-1 Docket No. 50-334, License No. DPR-66 BV-2 Docket No. 50-412, License No. NPF-73 Reactor Vessel Capsule Y Report Supplement 1 (Unit 1) and Reactor Vessel Capsule X Report Supplement 1 (Unit 2)”
August 27, 2007	ML072430180	Letter from P. Sena III to DCD, “Beaver Valley Power Station, Unit Nos. 1 and 2 BV-1 Docket No. 50-334, License No. DPR-66 BV-2 Docket No. 50-412, License No. NPF-73 License Renewal Application Boundary Drawings”
August 27, 2007	ML072430182	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR-Structures, Revision 1 “Site Map – In-Scope Structures.”
August 27, 2007	ML072430187	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-00-1, Revision 2 “Drawing Symbol Legend”
August 27, 2007	ML072430189	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-00-2, Revision 2 “Drawing Symbol Legend”
August 27, 2007	ML072430191	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-00-3, Revision 0 “System Numbers & System Names”
August 27, 2007	ML072430195	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-06-1, Revision 5 “Reactor Coolant System (RC)”
August 27, 2007	ML072430196	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-06-2, Revision 4 “Reactor Coolant System (RC)”
August 27, 2007	ML072430198	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-06-3, Revision 4 “Reactor Coolant System (RC)”
August 27, 2007	ML072430199	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-06-4, Revision 3 “Reactor Coolant System (RC)”
August 27, 2007	ML072430201	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-07-1, Revision 7 “Chemical and Volume Control System (CH)”
August 27, 2007	ML072430204	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-06-3, Revision 4 “Chemical and Volume Control System (CH)”
August 27, 2007	ML072430214	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-08-1, Revision 3 “Boron Recovery Degasifiers (BR)”
August 27, 2007	ML072430215	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-08-2, Revision 3 “Boron Recovery Ion Exchangers (BR)”
August 27, 2007	ML072430216	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-08-3, Revision 4 “Boron Recovery Evaporator (BR)”
August 27, 2007	ML072430207	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-07-3, Revision 5 “Chemical and Volume Control System (CH)”
August 27, 2007	ML072430210	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-07-4, Revision 5 “Chemical and Volume Control System (CH)”
August 27, 2007	ML072430211	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-07-5, Revision 4 “Chemical and Volume Control System (CH)”
August 27, 2007	ML072430219	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-08-4, Revision 5 “Boron Recovery Boric Acid Hold Tanks (BR)”

Date	Accession No.	Subject
August 27, 2007	ML072430220	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-08-5, Revision 4 "Boron Recovery PG Water Tanks (BR)"
August 27, 2007	ML072430221	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-08-6, Revision 4 "Boron Recovery PG Water Tanks (BR)"
August 27, 2007	ML072430223	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-08-7, Revision 3 "Boron Recovery PG Water Deaerator (BR)"
August 27, 2007	ML072430226	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-09-1, Revision 5 "Vent and drain System (DV)"
August 27, 2007	ML072430228	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-09-2, Revision 3 "Vent and drain System (DV)"
August 27, 2007	ML072430231	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-09-3, Revision 3 "Vent and drain System (DV)"
August 27, 2007	ML072430232	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-09-4, Revision 3 "Vent and drain System (DV)"
August 27, 2007	ML072430235	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-10-1, Revision 5 "Residual Heat Removal System (RH)"
August 27, 2007	ML072430238	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-11-1, Revision 6 "Safety Injection System (SI)"
August 27, 2007	ML072430239	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-11-2, Revision 6 "Safety Injection System (SI)"
August 27, 2007	ML072430240	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-12-1, Revision 4 "Containment Vacuum and Leakage Monitoring System (CV)"
August 27, 2007	ML072430241	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-13-1, Revision 4 "Containment Depressurization System (CV)"
August 27, 2007	ML072430243	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-13-2, Revision 3 "Containment Depressurization System (CV)"
August 27, 2007	ML072430244	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-14A-1, Revision 6 "Sample System (SS)"
August 27, 2007	ML072430245	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-14A-2, Revision 4 "Sample System (SS)"
August 27, 2007	ML072430247	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-14A-3, Revision 4 "Sample System (SS)"
August 27, 2007	ML072430248	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-14C-1, Revision 4 "Post-Accident Sampling System (PAS)"
August 27, 2007	ML072430250	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-15-1, Revision 4 "Component Cooling Water System (CCR)"
August 27, 2007	ML072430251	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-15-2, Revision 4 "Component Cooling System (CCR)"
August 27, 2007	ML072430252	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-15-3, Revision 4 "Component Cooling Water System (CCR)"
August 27, 2007	ML072430253	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-15-4, Revision 4 "Component Cooling Water System (CCR)"
August 27, 2007	ML072430254	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-15-5, Revision 5 "Component Cooling Water System (CCR)"

Date	Accession No.	Subject
August 27, 2007	ML072430257	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-16-1, Revision 3 “Ventilation and Air Conditioning – Primary Plant (VS)”
August 27, 2007	ML072430259	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-17-1, Revision 4 “Liquid Waste Disposal System (LW)”
August 27, 2007	ML072430262	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-17-2, Revision 4 “Liquid Waste Disposal System (LW)”
August 27, 2007	ML072430263	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-17-3, Revision 3 “Liquid Waste Disposal System (LW)”
August 27, 2007	ML072430268	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-18-1, Revision 3 “Solid Waste Disposal System (SW)”
August 27, 2007	ML072430272	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-18-2, Revision 2 “Solid Waste Disposal System (SW)”
August 27, 2007	ML072430273	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-18-3, Revision 3 “Solid Waste Disposal System (SW)”
August 27, 2007	ML072430275	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-19-1, Revision 4 “Gaseous Waste Disposal System (GW)”
August 27, 2007	ML072430276	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-19-2, Revision 3 “Gaseous Waste Disposal System (GW)”
August 27, 2007	ML072430279	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-20-1, Revision 3 “Fuel Pool Cooling and Purification System (PC)”
August 27, 2007	ML072430281	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-21-1, Revision 5 “Main Steam System (MS)”
August 27, 2007	ML072430288	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-21-2, Revision 3 “Main Steam System (MS)”
August 27, 2007	ML072430291	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-21-3, Revision 4 “Main Steam System (MS)”
August 27, 2007	ML072430294	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-21-3, Revision 4 “Main Steam System (NG)”
August 27, 2007	ML072430296	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-22-1, Revision 3 “Condensate System (CN)”
August 27, 2007	ML072430300	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-24-1, Revision 5 “Feederwater System (FW)”
August 27, 2007	ML072430301	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-24-2, Revision 4 “Feederwater System (FW)”
August 27, 2007	ML072430305	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-24-3, Revision 3 “Feederwater System (FW)”
August 27, 2007	ML072430307	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-25-1, Revision 4 “Steam Generator Blowdown System (BD)”
August 27, 2007	ML072430312	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-26-4, Revision 4 “Steam Generator Blowdown System (BD)”
August 27, 2007	ML072430315	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-26-6, Revision 3 “Steam Generator Blowdown System (BD)”
August 27, 2007	ML072430316	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-27-1, Revision 3 “Steam Generator Blowdown System (BD)”
August 27, 2007	ML072430321	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-27-2, Revision 4 “Auxiliary Steam System (AS)”
August 27, 2007	ML072430322	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-27-4, Revision 2 “Auxiliary Steam System (AS)”

Date	Accession No.	Subject
August 27, 2007	ML072430323	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-29-1, Revision 3 “Air Conditioning Chilled Water System (AC)”
August 27, 2007	ML072430325	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-29-2, Revision 3 “Air Conditioning Chilled Water System (AC)”
August 27, 2007	ML072430327	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-30-1, Revision 4 “River Water System (RW)”
August 27, 2007	ML072430328	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-30-2, Revision 4 “River Water System (RC)”
August 27, 2007	ML072430338	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-32-6, Revision 3 “Water Treating System (WT)”
August 27, 2007	ML072430339	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-32-7, Revision 3 “Water Treating System (WT)”
August 27, 2007	ML072430342	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-32-8, Revision 3 “Chemical Feed System (WT)”
August 27, 2007	ML072430344	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-32-9, Revision 5 “Filtered Water System (WF)”
August 27, 2007	ML072430346	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-33-1, Revision 4 “Fire Protection System (WF)”
August 27, 2007	ML072430352	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-33-2, Revision 3 “Fire Protection System (WF)”
August 27, 2007	ML072430357	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-33-3, Revision 4 “Fire Protection –C02 System (FP)”
August 27, 2007	ML072430358	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-33-4, Revision 4 “Fire Protection – Halon and C02 System (FP)”
August 27, 2007	ML072430330	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-30-3, Revision 4 “River Water System (RC)”
August 27, 2007	ML072430332	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-30-4, Revision 4 “River Water System (RC)”
August 27, 2007	ML072430335	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-32-2, Revision 3 “Water Treating System (WT)”
August 27, 2007	ML072430359	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-33-7, Revision 3 “Fire Protection System Details (FP)”
August 27, 2007	ML072430361	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-33-8, Revision 3 “Fire Protection System Details (FP)”
August 27, 2007	ML072430363	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-33-3, Revision 4 “Station Compressed Air System (SA)”
August 27, 2007	ML072430370	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-34-8, Revision 4 “Air System – Intake Structure Watertight Doors (VS) ”
August 27, 2007	ML072430371	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-36-1, Revision 4 “Emergency Diesel Generator Air Start System (DA)”
August 27, 2007	ML072430373	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-36-2, Revision 4 “Emergency Diesel Generator Fuel Oil System (FO)”
August 27, 2007	ML072430364	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-34-2, Revision 4 “Instrument Air and Containment Instrument Air System (IA)”
August 27, 2007	ML072430366	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-34-5, Revision 2 “Instrument Air for PAB (IA)”
August 27, 2007	ML072430368	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-34-6, Revision 4 “Instrument Air System (IA)”

Date	Accession No.	Subject
August 27, 2007	ML072430375	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-36-3, Revision 3 “Emergency Diesel Generator Lube Oil System (DLO)”
August 27, 2007	ML072430376	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-36-4, Revision 4 “Emergency Diesel Generator Water Cooling System (DCW)”
August 27, 2007	ML072430379	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-36-5, Revision 3 “Emergency Diesel Generator - Air Intake and Exchange System (EE)”
August 27, 2007	ML072430380	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-41A-1, Revision 3 “Hot Water Heating System (HS)”
August 27, 2007	ML072430383	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-41A-2, Revision 3 “Hot Water Heating System (HS)”
August 27, 2007	ML072430385	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-41A-3, Revision 4 “Hot Water Heating System (HS)”
August 27, 2007	ML072430387	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-41B-1, Revision 3 “Glycol Solution Heating System (HS)”
August 27, 2007	ML072430391	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-41C-1, Revision 4 “Domestic Water System (PL)”
August 27, 2007	ML072430393	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-41D-1, Revision 3 “Turbine & Service Building & Yard Drains System (RD)”
August 27, 2007	ML072430394	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-41D-2, Revision 3 “Turbine & Service Building & Yard Drains System (RD)”
August 27, 2007	ML072430395	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-43-2, Revision 3 “Radiation Monitoring System (RM)”
August 27, 2007	ML072430397	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-43-3, Revision 3 “Radiation Monitoring System (RM)”
August 27, 2007	ML072430403	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-43-5, Revision 3 “Radiation Monitoring System (RM)”
August 27, 2007	ML072430407	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-44A-1, Revision 3 “Control Room Emergency Pressurization Air System (VS)”
August 27, 2007	ML072430410	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-44A-2, Revision 4 “Control Room Air Conditioning System (VS)”
August 27, 2007	ML072430411	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-44A-4, Revision 4 “Control Room Air Conditioning System (VS)”
August 27, 2007	ML0724304132	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-44B-1, Revision 3 “Air Vent and Cooling System (VS)”
August 27, 2007	ML072430416	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-44E-1, Revision 3 “Switchgear Air Conditioning System (VS)”
August 27, 2007	ML072430418	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-44E-3, Revision 4 “Switchgear Air Conditioning System (VS)”
August 27, 2007	ML072430423	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-44F-1, Revision 3 “Alternate Intake Structure Ventilation System (VS)”
August 27, 2007	ML072430426	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-45F-1, Revision 4 “Security Diesel Generator System (NHS)”
August 27, 2007	ML072430428	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-46-1, Revision 4 “Post DBA Hydrogen Control System (HY)”

Date	Accession No.	Subject
August 27, 2007	ML072430429	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-46-2, Revision 4 "Post DBA Hydrogen Analyzer System (HY)"
August 27, 2007	ML072430430	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-47-1, Revision 3 "Containment System (VS)"
August 27, 2007	ML072430435	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-58E-1, Revision 4 "ERF Diesel Fuel Oil System (RGF)"
August 27, 2007	ML072430439	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-58E -2, Revision 4 "ERF Diesel Water System (RGW)"
August 27, 2007	ML072430440	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-58E -3, Revision 3 "ERF Diesel Lube Oil System (RGO)"
August 27, 2007	ML072430440	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-58E -3, Revision 3 "ERF Diesel Lube Oil System (RGO)"
August 27, 2007	ML072430481	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 2-33-3, Revision 4 "Fire Protection System – Halon Control Building (FPG)"
August 27, 2007	ML072430625	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 2-43-18, Revision 3 "Radiation Monitoring System (HVS)"
August 27, 2007	ML072430648	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 2-44F -1, Revision 4 "Main & Alternate Intake Structure & Cooling Tower Pump House Ventilation System (HVW)"
August 27, 2007	ML072430914	Letter from P. Sena III to NRC DCD, "Beaver Valley Power Station, Unit Nos. 1 and 2 BV-1 Docket No. 50-334, License No. DPR-66 BV-2 Docket No. 50-412, License No. NPF-73 License Renewal Application Cove r Letter"
August 27, 2007	ML072430916	License-Application for Facility Operating License (Amend/Renewal) DKT 50 Beaver Valley Power Station License Renewal Application. Cover to table 3.3.2-14
August 27, 2007	ML072470493	License-Application for Facility Operating License (Amend/Renewal) DKT 50 Beaver Valley Power Station License Renewal Application. Table 3.3.2-15 to Appendix D
August 27, 2007	ML072470523	License-Application for Facility Operating License (Amend/Renewal) DKT 50 Beaver Valley Power Station License Renewal Application. Appendix E: Applicant's Environmental Report
September 7, 2007	ML072500082	Press Release 07-116 - LICENSE LENEWAL APPLICATION FOR BEAVER VALLEY NUCLEAR PLANT AVAILABLE FOR PUBLIC INSPECTION
September 18, 2007	ML072670501	BV EPU I&C Questions
September 18, 2007	ML072340332	Letter from P. Kuo to P. Sena III, "RECEIPT AND AVAILABILITY OF THE LICENSE RENEWAL APPLICATION FOR THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2"
September 18, 2007	ML072340374	Federal Register Notice, "NOTICE OF RECEIPT AND AVAILABILITY OF APPLICATION FOR RENEWAL OF BEAVER VALLEY POWER STATION, UNITS 1 AND 2 FACILITY OPERATING LICENSE NOS. DPR-66 AND NPF-73 FOR AN ADDITIONAL 20-YEAR PERIOD DOCKET NOS. 50-334 AND 50-412"

Date	Accession No.	Subject
September 26, 2007	ML072330337	SUMMARY OF MEETING HELD ON AUGUST 2, 2007, BETWEEN THE U.S. NUCLEAR REGULATORY COMMISSION STAFF AND FIRSTENERGY NUCLEAR OPERATING COMPANY REPRESENTATIVES TO DISCUSS THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION
October 22, 2007	ML072900312	Letter from P. Kuo to P. Sena III, “DETERMINATION OF ACCEPTABILITY AND SUFFICIENCY FOR DOCKETING, PROPOSED REVIEW SCHEDULE, AND OPPORTUNITY FOR A HEARING REGARDING THE APPLICATION FROM FIRSTENERGY NUCLEAR OPERATING COMPANY, FOR RENEWAL OF THE OPERATING LICENSES FOR THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2”
October 22, 2007	ML072900397	Federal Register Notice - UNITED STATES NUCLEAR REGULATORY COMMISSION FIRSTENERGY NUCLEAR OPERATING COMPANY BEAVER VALLEY POWER STATION, UNITS 1 AND 2 NOTICE OF ACCEPTANCE FOR DOCKETING OF THE APPLICATION AND NOTICE OF OPPORTUNITY FOR HEARING REGARDING RENEWAL OF FACILITY OPERATING LICENSE NOS. DPR-66 AND NPF-73 FOR AN ADDITIONAL 20-YEAR PERIOD DOCKET NOS. 50-334 and 50-412
October 26, 2007	ML072990171	Press Release 07-141 - NRC ANNOUNCES OPPORTUNITY TO REQUEST HEARING ON LICENSE RENEWAL APPLICATION FOR BEAVER VALLEY NUCLEAR PLANT
November 8, 2007	ML073100576	Memorandum from K. Howard to R. Franovich, “FORTHCOMING MEETING TO DISCUSS THE SAFETY REVIEW PROCESS OVERVIEW AND ENVIRONMENTAL SCOPING PROCESS FOR BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION REVIEW“
November 8, 2007	ML073120267	Press Release 1-07-058 - NRC TO DISCUSS PROCESS FOR REVIEW OF LICENSE RENEWAL APPLICATION FOR BEAVER VALLEY NUCLEAR PLANT, SEEK ENVIRONMENTAL INPUT
December 8, 2007	ML073610255	Letter from P. Sena III to NRC DCD, “Corrections to the Beaver Valley Power Station License Renewal Application Boundary Drawings”
December 21, 2007	ML073610289	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-15-3, Revision 5 “Component Cooling Water System (CCR)”
December 21, 2007	ML073610290	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-17-3, Revision 4 “Liquid Waste Disposal System (LW)”
December 21, 2007	ML073610291	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-30-3, Revision 5 “River Water System (RW)”
December 21, 2007	ML073610294	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-33-1, Revision 5 “Fire Protection – Water System (FP)”
December 21, 2007	ML073610295	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-36-2, Revision 5 “Emergency Diesel Generator Fuel Oil System (FO)”
December 21, 2007	ML073610297	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 2-36-3, Revision 4 “Diesel Starting Air System (EGA)”

Date	Accession No.	Subject
February 12, 2008	ML080460505	Letter from P. Sena III to NRC DCD, “License Renewal Application Amendment 1: Revision to Reactor Vessel Integrity Aging Management Program Information and Details of Reactor Vessel Surveillance Capsule Withdrawal Schedule Information”
March 3, 2008	ML080590262	Letter from K. Howard to P. Sena III, “REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)”
March 5, 2008	ML080640216	Letter from K. Howard to P. Sena III, “REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NO. MD6593, MD6594)”
March 5, 2008	ML080601020	Letter from K. Howard to P. Sena III, “REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)”
March 21, 2008	ML080720288	Letter from K. Howard to P. Sena III, “REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)”
March 26, 2008	ML080790744	Letter from K. Howard to P. Sena III, “REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND 6594)”
March 31, 2008	ML080940397	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-44B-1, Revision 4 “Air Vent and Cooling System (VS)”
March 31, 2008	ML080940399	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 2-47-1, Revision 5 “Containment Air Locks & Fuel Transfer Tube System (PHS)”
April 1, 2008	ML080790392	Letter from K. Howard to P. Sena III, “REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND 6594)”
April 1, 2008	ML080790538	Letter from K. Howard to P. Sena III, “REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)”
April 2, 2008	ML080980212	Letter from P. Sena III to NRC DCD, “Reply to Request for Additional Information for Review of the Beaver Valley Power Station, Units 1 and 2. License Renewal Application (TAC Nos. MD6593 and MD6594), and License Renewal Application Amendment No. 5, L-08-124”
April 3, 2008	ML080790735	Letter from K. Howard to P. Sena III, “REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)”

Date	Accession No.	Subject
April 3, 2008	ML081000296	Letter from P. Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), License Renewal Application Amendment No. 4, and Revised License Renewal Boundary Drawings, L-08-123"
April 3, 2008	ML081000322	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-017-2, Revision 4 "Chemical Volume and Control System"
April 3, 2008	ML081000323	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-07-3, Revision 6 "Chemical Volume and Control System"
April 3, 2008	ML081000324	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-08-1, Revision 4 "Boron Recovery Degasifiers"
April 3, 2008	ML081000326	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-09-2, Revision 4 "Vent and Drain System"
April 3, 2008	ML081000327	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-12-1, Revision 5 "Containment Vacuum and Leakage Monitoring System"
April 3, 2008	ML081000328	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 1-14A-1, Revision 7 "Sample System"
April 3, 2008	ML081000329	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-14A-2, Revision 5 "Sample System"
April 3, 2008	ML081000330	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-19-1, Revision 5 "Gaseous Waste Disposal System"
April 3, 2008	ML081000331	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-24-1, Revision 6 "Feedwater System"
April 3, 2008	ML081000332	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-30-1, Revision 5 "River Water System"
April 3, 2008	ML081000333	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-46-2, Revision 5 "Post DBA Hydrogen System"
April 17, 2008	ML080980483	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
April 17, 2008	ML081050333	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
April 18, 2008	ML081130155	Letter from P. Sena III to NRC DCD, "Reply to Request for Additional Information for Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), and License Renewal Application Amendment No. 6, L-08-143"
April 25, 2008	ML081200596	Letter from P. Sena III to NRC DCD, "Request for Schedule Change for Advisory Committee on Reactor Safeguards Subcommittee Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Safety Evaluation Report, L-08-145"
April 25, 2008	ML081200597	Letter from P. Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2. License Renewal Application (TAC Nos. MD6593 and MD6594), L-08-144"

Date	Accession No.	Subject
April 28, 2008	ML081130394	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
April 30, 2008	ML081050270	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
April 30, 2008	ML081230618	Letter from P. Sena III to NRC DCD, "Reply to Request for Additional Information for Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), and License Renewal Application Amendment No. 7, L-08-146“
May 2, 2008	ML081270236	Letter from P. Sena III to NRC DCD, "Reply to Request for Additional Information for Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), and License Renewal Application Amendment No. 7, L-08-174“
May 5, 2008	ML081280490	Letter from P. Sena III to NRC DCD, "Reply to Request for Additional Information for Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), and License Renewal Application Amendment No. 7, L-08-149“
May 5, 2008	ML081410416	Letter from P. Sena III to NRC DCD, "Correction to Reply to Request for Additional Information for the Review of Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), License Renewal Application Amendment No. 8, and Revised License Renewal Boundary Drawings, L-08-150“
May 8, 2008	ML081050543	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
May 8, 2008	ML081160467	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
May 8, 2008	ML081200920	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
May 8, 2008	ML081410417	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 2-30-1, Revision 4 "Service Water System (SWS)"
May 8, 2008	ML081410419	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR – Structures, Revision 2, site Map – In-Scope Structures.

Date	Accession No.	Subject
May 15, 2008	ML081120539	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
May 19, 2008	ML081420368	Letter from P. Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), L-08-169"
May 19, 2008	ML081440543	Letter from P. Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), License Renewal Application Amendment No. 9. and Revised License Renewal Boundary Drawings, L-08-170"
May 19, 2008	ML081440711	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 2-34-2, Revision 2 " Station Instrument Air (IAS)".
May 19, 2008	ML081440712	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 2-34-3, Revision 7 " Containment Instrument Air System (IAC)".
May 19, 2008	ML081440714	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 2-34-10, Revision 1 "Containment Instrument Air (IAC)".
May 19, 2008	ML081440716	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing 2-34-11, Revision 2 "Instrument Air Standby Train (IAS)".
May 22, 2008	ML081130412	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
May 22, 2008	ML081360557	Letter from K. Howard to P. Sena III, "REVISION OF SCHEDULE FOR THE CONDUCT OF REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593, MD6594, MD6595 AND MD6596)"
May 28, 2008	ML081150577	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
May 28, 2008	ML081510406	Letter from Pete Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594)" L-08-180
June 2, 2008	ML081560245	Letter from Pete Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594)" L-08-147
June 4, 2008	ML081430687	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"

Date	Accession No.	Subject
June 5, 2008	ML081540195	Letter from R. Franovich to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWALAPPLICATION (TAC NOS. MD6593 AND MD6594)"
June 6, 2008	ML081620356	Letter from Pete Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 10" L-08-181
June 9, 2008	ML081640097	Letter from Pete Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 12" L-08-190
June 9, 2008	ML081640505	Letter from Pete Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), License Renewal Application Amendment No. 11, and Revised License Renewal Boundary Drawings" L-08-189
June 9, 2008	ML081640592	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 2-30-1, Revision 4 "Sample System (SS)"
June 9, 2008	ML081640593	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-21-1, Revision 6 "Main Steam System (MS)"
June 9, 2008	ML081640594	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-22-1, Revision 4 "Condensate System (CN)"
June 9, 2008	ML081640595	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-24-2, Revision 5 "Feedwater System (FW)"
June 9, 2008	ML081640596	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-24-4, Revision 4 "Feedwater System (FW)"
June 9, 2008	ML081640597	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-25-1, Revision 5 "Steam Generator Blowdown System (BD)"
June 9, 2008	ML081640598	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-32-7, Revision 4 "Water Treating System (WT)"
June 9, 2008	ML081640599	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-45F-1, Revision 5 "Security Diesel Generator System (NHS)"
June 9, 2008	ML081640600	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-58E-1, Revision 5 "Diesel Fuel Oil System (RGF)"
June 9, 2008	ML081640601	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 2-14A-1, Revision 6 "Reactor Plant Sample System (SSR)"
June 9, 2008	ML081640602	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 2-15-1, Revision 5 "Primary Component Coolant System (CCP)"
June 9, 2008	ML081640603	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 2-15-6, Revision 5 "Primary Component Coolant System (CCP)"
June 9, 2008	ML081640604	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 2-24-2A, Revision 4 "main Feedwater System (FWS)"
June 9, 2008	ML081640605	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 2-27A-2, Revision 4 "Auxiliary Steam and Condensate System (ASS)"

Date	Accession No.	Subject
June 16, 2008	ML08700236	Letter from Pete Sena III to NRC DCD, “Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 13” L-08-188
June 17, 2008	ML08700652	Letter from Pete Sena III to NRC DCD, “Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 14” L-08-191
July 21, 2008	ML082060074	Letter from Pete Sena III to NRC DCD, “Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2. License Renewal Application (TAC Nos. MD6593 and MD6594), and License Renewal Application Amendment No. 17, L-08-212“
July 24, 2008	ML082100073	Letter from Pete Sena III to NRC DCD, “Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 19, L-08-213”
July 24, 2008	ML082100075	Letter from Pete Sena III to NRC DCD, “Supplement to Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), L-08-227”
July 24, 2008	ML082100307	Letter from Pete Sena III to NRC DCD, “Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 18, L-08-211”
July 24, 2008	ML082100375	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR-Structures, Revision 4, Site Map – In-Scope Structures.”
August 1, 2008	ML082180124	Letter from Pete Sena III to NRC DCD, “Responses to a Request for Additional Information in Support of License Amendment Request No. 07-005 (TAC Nos. MD7531 and MD7532), L-08-229”
August 7, 2008	ML082120586	SUMMARY OF TELEPHONE CONFERENCE CALL HELD ON JULY 1, 2008, BETWEEN THE U.S. NUCLEAR REGULATORY COMMISSION AND FIRSTENERGY NUCLEAR OPERATING COMPANY, CONCERNING REQUESTS FOR ADDITIONAL INFORMATION PERTAINING TO THE EAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION
August 13, 2008	ML082270597	Letter from Pete Sena III to NRC DCD, “Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 20, L-08-260”

Date	Accession No.	Subject
August 22, 2008	ML082390814	Letter from Pete Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 21, L-08-226"
August 22, 2008	ML082390815	Letter from Pete Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 22, L-08-269"
August 22, 2008	ML082390816	Letter from Pete Sena III to NRC DCD, "Schedule for Submittal of Annual Update for the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), L-08-261"
September 3, 2008	ML082401708	Letter from K. Howard to P. Sena III, "REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BEAVER VALLEY POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. MD6593 AND MD6594)"
September 8, 2008	ML082550686	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 2-34-2, Revision 3 "Station Instrument Air (IAS)"
September 8, 2008	ML082550687	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-24-2, Revision 6 "Feedwater System (FW)"
September 8, 2008	ML082550688	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-41C-1, Revision 5 "Domestic Water System (PL)"
September 8, 2008	ML082550689	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 2-31-1, Revision 5 "Demineralized Water System (WTD)"
September 8, 2008	ML082550693	Letter from Pete Sena III to NRC DCD, "License Renewal Application Amendment No. 23 (TAC Nos. MD6593 and MD6594) and Revised License Renewal Boundary Drawings, L-08-262"
September 11, 2008	ML082730717	Letter from Pete Sena III to NRC DCD, "License Renewal Application Amendment No. 24 (TAC Nos. MD6593 and MD6594), L-08-263"
September 22, 2008	ML082740204	Letter from Pete Sena III to NRC DCD, "Submittal of Corrected WCAP15571 Supplement 1 and WCAP15571-NP, L-08-289"`
October 2, 2008	ML082800177	Letter from Pete Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 25, L-08-287"
October 2, 2008	ML082800180	Letter from Pete Sena III to NRC DCD, "License Renewal Application Amendment No. 26 (TAC Nos. MD6593 and MD6594), L-08-316"
October 3, 2008	ML082810100	Letter from Pete Sena III to NRC DCD, "Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 27, L-08-310"

Date	Accession No.	Subject
October 3, 2008	ML082810106	Letter from Pete Sena III to NRC DCD, “Supplement to Reply to Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594) and License Renewal Application Amendment No. 28, L-08-309“
October 10, 2008	ML082890154	Letter from Pete Sena III to NRC DCD, “Supplemental Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), L-08-324“
October 10, 2008	ML082900489	Letter from Pete Sena III to NRC DCD, “Response to Request for Additional Information - 2007 Steam Generator Tube Inspections (TAC No. MD8392), L-08-297“
October 24, 2008	ML083030071	Letter from Pete Sena III to NRC DCD, “Supplement to Information Provided in License Renewal Application Amendment No. 23 (TAC Nos. MD6593 and MD6594) Regarding Submersible Cable Suitability, L-08-288“
October 24, 2008	ML083040268	Letter from Pete Sena III to NRC DCD, “License Renewal Application Amendment No. 29 (Annual Update) (TAC Nos. MD6593 and MD6594) and Revised License Renewal Application Boundary Drawing, L-08-292“
October 30, 2008	ML083040266	Beaver Valley Power Station, Unit Nos. 1 and 2 Drawing LR 1-21-1, Revision 7 “Main Steam System (MS)”
November 04, 2008	ML083090886	Press Release I-08-060, “NRC TO DISCUSS RESULTS OF LICENSE RENEWAL INSPECTION FOR BEAVER VALLEY NUCLEAR POWER PLANT ON NOV. 12”
November 11, 2008	ML082140838	Letter from K. Howard to P. Sena III, “AUDIT REPORT REGARDING THE BEAVER VALLEY POWER STATION, UNIT 1 AND 2, LICENSE RENEWAL APPLICATION”
November 13, 2008	ML083010249	Summary of Telephone Conference Call Held on 10/8/08, between the NRC and FirstEnergy Nuclear Operating Company, Concerning Open Items Pertaining to the BVPS, Units 1 and 2, License Renewal SER.
November 13, 2008	ML083020290	Summary of Telephone Conference Call Held on 8/28/08, between the NRC and FENOC, Concerning RAI Pertaining to the BVPS, Units 1 and 2, LRA.
December 15, 2008	ML083250640	Summary of Telephone Conference Call Held 11/14/08, between the NRC and FENOC, Concerning RAIs Pertaining to the Beaver Valley Power Station, Units 1 and 2, License Renewal Application.
December 17, 2008	ML083230667	10/22/2008 - Summary of Telephone Conference Call Between the NRC and FirstEnergy Nuclear Operating Company, Concerning RAIs Pertaining to the Beaver Valley Power Station, Units 1 and 2, License Renewal Application.
December 19, 2008	ML083250420	Summary of Telephone Conference Call Held on 11/17/08, between the NRC and FENOC, Concerning Requests for Additional Information Pertaining to the Beaver Valley Power Station, Units 1 and 2, LRA.
December 19, 2008	ML083590223	Letter from Pete Sena III to NRC DCD, “Supplemental Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application (TAC Nos. MD6593 and MD6594), and License Renewal Amendment No. 32,” L-08-292“
December 22, 2008	ML083650066	Beaver Valley, Units 1 and 2 - License Renewal Application, Amendment No. 33.

Date	Accession No.	Subject
January 09, 2009	ML083660029	10/30/08 Summary of Public Meeting on the Draft Supplemental Environmental Impact Statement Regarding the Beaver Valley Power Station, License Renewal Review.
January 09, 2009	ML090080046	Safety Evaluation Report With Open Item Related To The License Renewal Of Beaver Valley Power Station, Units 1 and 2.
January 09, 2009	ML090120360	Beaver Valley, Units 1 & 2, Safety Evaluation Report.
January 19, 2009	ML090220216	Beaver Valley, Units 1 & 2, Supplemental Information for the Review of the License Renewal Application and License Renewal Application Amendment No. 34. (
January 21, 2009	ML083500325	Summary of Telephone Conf Call Held on Sept. 26, 2008 Between NRC and FirstEnergy Nuclear Operating Company Concerning the RAI Pertaining to the Refurbishment Activities at the BVPS. Units 1&2 LRA.
February 04, 2009	ML090500815	Transcript of the ACRS Plant License Renewal Subcommittee Meeting (Beaver Valley) on February 4, 2009, Pages 1-146.
February 24, 2009	ML090220553	Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application. (
March 24, 2009	ML090850433	Beaver Valley, Units 1 & 2, Reply to Request for Additional Information for Review of License Renewal Application.
May 07, 2009	ML091260025	Request for Additional Information for the Review of the Beaver Valley Power Station, Units 1 and 2, License Renewal Application.
May 12, 2009	ML091250413	Final Supplement 36 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) Regarding Beaver Valley Power Station, Units 1 and 2 (TAC Nos. MD6595 and MD6596).
May 12, 2009	ML091260024	Final Supplement 36 to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (BVPS).
May 14, 2009	ML091250363	Notice of Availability of the Final Plant-Specific Supplement 36 to the GEIS for License Renewal of Nuclear Plants Regarding Beaver Valley Power Station.
May 14, 2009	ML091380033	Beaver Valley, Unit 1 and 2 - License Renewal Application, Amendment No. 36.
May 20, 2009	ML091400166	Docketing of NRC Teleconference Notes Pertaining to the License Renewal of the Beaver Valley Power Station, Units 1 and 2.
May 20, 2009	ML091420273	Beaver Valley, Units 1 and 2, License Renewal Application Amendment No. 37
May 31, 2009	ML091260011	NUREG-1437 Supplement 36 "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Beaver Valley Power Station Units 1 and 2" Final Report.

Date	Accession No.	Subject
June 01, 2009	ML091540012	Beaver Valley, Units 1 and 2 - Reply to Request for Additional Information on License Renewal Application Amendment No. 38
June 08, 2009	ML091560200	Docketing of NRC Teleconference Notes Pertaining to the License Renewal of the Beaver Valley Power Station, Units 1 and 2

APPENDIX C

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APPENDIX D

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