NUREG-1891

Safety Evaluation Report
Related to the License Renewal of Pilgrim Nuclear Power Station

Docket No. 50-293

Entergy Nuclear Operations, Inc.

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001

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ABSTRACT

This safety evaluation report (SER) documents the technical review of the Pilgrim Nuclear Power Station (PNPS) license renewal application (LRA) by the United States (US) Nuclear Regulatory Commission (NRC) staff (the staff). By letter dated January 25, 2006, Entergy Nuclear Operations, Inc. (ENO 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." ENO requests renewal of the PNPS operating license (Facility Operating License Number DPR-35) for a period of 20 years beyond the current expiration at midnight June 8, 2012.

PNPS is located approximately 4 miles southeast of Plymouth, Massachusetts. The NRC issued the PNPS construction permit on August 26, 1968, and operating license on September 15, 1972. PNPS is a Mark 1 boiling water reactor design. General Electric supplied the nuclear steam supply system and Bechtel Corporation originally designed and constructed the balance of plants. The PNPS licensed power output is 2028 megawatt thermal with a gross electrical output of approximately 690 megawatt electric.

This SER presents the status of the staff's review of information submitted through September 12, 2007, the cutoff date for consideration in the SER. The staff identified open items that were resolved before the staff made a final determination on the application. SER Section 1.5 summarizes these items and their resolution. Section 6.0 provides the staff's final conclusion on the review of the PNPS LRA.

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ABBREVIATIONS

AAC	alternate alternating current
AC	alternating current
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ADS	automatic depressurization system
AEC	Atomic Energy Commission
AEM	Aging effect/mechanism
AERM	aging effect requiring management
AISC	American Institute of Steel Construction
AMP	aging management program
AMR	aging management review
ANSI	American National Standards Institute
AOG	augmented off-gas
ARI	alternate rod insertion
ART	adjusted reference temperature
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
AWWA	American Water Works Association
BADGER	boron-10 areal density gage for evaluating racks
B&PV	Boiler and Pressure Vessel
BECo	Boston Edison Company
BWR	boiling water reactor
BWRVIP	boiling water reactor vessel and internals program
CAS	compressed air system
CASS	cast austenitic stainless steel
CAV	crack arrest verification
CCW	closed cooling water
CDE	condensate demineralized effluent
CDS	condensate demineralizer system
CE	conducts electricity
CEA	control element assembly
CEOG	Combustion Engineering Owners Group
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	control rod
CRD	control rod drive
CRGT	control rod guide tube
CRL	component record list

CSCS	core standby cooling systems
CST	condensate storage and transfer
CUF	cumulative usage factor
C_vUSE	Charpy upper-shelf energy
CW	circulating water
CWS	circulating water system
DBA	design-basis accident
DBD	design-basis document
DBE	design-basis event
DC	direct current
DOR	Division of Operating Reactors
EACS	equipment area cooling system
ECCS	emergency core cooling system
EDG	emergency diesel generator
EFPD	effective full-power days
EFPY	effective full-power years
EIC	electrical and instrumentation and control
EN	shelter or protection
ENGC	Entergy Nuclear Generation Company
ENN	Entergy Nuclear Northeast
ENO	Entergy Nuclear Operations
EOL	end of life
EPRI	Electric Power Research Institute
EQ	environmental qualification
ER	Applicant's Environmental Report—Operating License Renewal Stage
ESF	engineered safety features
FAC	flow-accelerated corrosion
FAVOR	Fracture Analysis of Vessels - Oak Ridge
FB	fire barrier
FC	flow control
FD	flow distribution
F_{en}	fatigue life correction factor
FERC	Federal Energy Regulatory Commission
FF	fluence factor
FIV	flow-induced vibration
FLB	flood barrier
FLT	filtration
FLV	floodable volume
FP	fire protection
FPC	fuel pool cooling
FR	Federal Register
FSAR	final safety analysis report
ft-lb	foot-pound
FW	feedwater

GALL	NUREG-1801, Generic Aging Lessons Learned Report
GDC	general design criterion
GE	General Electric
GEIS	general environmental impact statement
GL	generic letter
GRP	gaseous release path
GSI	generic safety issue
H_2	hydrogen
HAZ	heat-affected zone
HELB	high-energy line break, HELB shielding
HPCI	high pressure coolant injection
HPSI	high pressure safety injection
HS	heat sink
HT	heat transfer
HVAC	heating, ventilation, and air conditioning
HWC	hydrogen water chemistry
I&C	instrumentation and controls
IAS	instrument air system
IASCC	irradiation-assisted stress corrosion cracking
ID	inner diameter
IEEE	Institute of Electrical and Electronic Engineers
IGSCC	inter-granular stress corrosion cracking
IN	Information Notice, insulation (electrical)
INEL	Idaho National Engineering Laboratory
INS	insulation
IPA	integrated plant assessment
IPN	instrumentation penetration nozzle
IR	insulation resistance
ISA	Instrumentation, Systems, and Automation Society
ISG	Interim Staff Guidance
ISI	inservice inspection
ISP	integrated surveillance program
ksi	1000 pounds per square inch
KV or kV	kilo-volt
KW	kilo-watt
LOCA	loss of coolant accident
LPCI	low-pressure coolant injection
LR	license renewal
LRA	license renewal application
LRBD	license renewal boundary drawing
LRPD	license renewal procedure document/license renewal project report
LRPG	license renewal project guideline

MB	missile barrier
MEB	metal-enclosed bus
MeV	mega-electron volt
MIC	microbiologically influenced corrosion
MS	main steam
MSIV	main steam isolation valve
MWe	megawatts-electric
MWt	megawatts-thermal
N_2	nitrogen
NA	neutron absorption
NaOH	sodium hydroxide
n/cm^2	neutrons per square centimeter
NDE	non-destructive examinations
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NPS	nominal pipe size
NRC	Nuclear Regulatory Commission
NSSS	nuclear steam supply system
NUREG	nuclear regulation document
O_2	oxygen
OI	open item
PASS	post-accident sampling system
PB	pressure boundary
PBO	pressure boundary only
PBOC	pipe breaks outside containment
PCAC	primary containment atmospheric
PCP	primary containment penetration
PFM	probabilistic fracture mechanics
pH	potential hydrogen
P&ID	piping and instrumentation diagram
PLI	project level instruction
PLT	plateout
PNPS	Pilgrim Nuclear Power Station
ppm	parts per million
PP	position paper
PSPM	periodic surveillance and preventive maintenance
P-T	pressure-temperature
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
QA	quality assurance
QAPM	Quality Assurance Program Manual

Q-list	safety-related SSCs included in the quality assurance program
RAI	request for additional information
RAMA	Radiation Analysis Modeling Application
RBCCW	reactor building closed cooling water
RCCA	rod cluster control assembly
RCIC	reactor core isolation cooling
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RFO	refueling outage
RG	regulatory guide
RHR	residual heat removal
RI-ISI	risk-informed inservice inspection
RIS	regulatory issue summary
RMS	radiation monitoring system
RPV	reactor pressure vessel
RR	reactor recirculation
RRS	reactor recirculation system
RT	radiographic test
RTD	resistance temperature detector
RV	reactor vessel
RVI	reactor vessel internals
RVID	reactor vessel integrity database
RWCU	reactor water cleanup
SAND	Sandia National Laboratory
SBO	station blackout
SBODG	station blackout diesel generator
SCC	stress corrosion cracking
SC	structure and component
SCS	secondary containment system
SDC	shutdown cooling
SE	safety evaluation
SER	Safety Evaluation Report
SFP	spent fuel pool
SGTS	standby gas treatment system
SIA	Structural Integrity Associates
SIR	safeguards implementation report
SLC	standby liquid control
SNS	support for Criterion (a)(2) equipment
SPC	suppression pool cooling
SRE	support for Criterion (a)(3) equipment
SREVS	switchgear room emergency ventilation system
SRP	Standard Review Plan
SRP-LR	Standard Review Plan for License Renewal
SRV	safety/relief valve
SS	stainless steel
SSC	system, structure, or component

SSER	Supplemental Safety Evaluation Report
SSR	support for Criterion (a)(1) equipment
SSW	salt service water
STR	structural integrity
TBCCW	turbine building closed cooling water
TBS	turbine bypass system
TLAA	time-limited aging analysis
TS	technical specification
TSC	technical support center
TSS	turbine sealing system
US	United States
UFSAR	updated final safety analysis report
UPS	uninterruptible power supply
USAR	updated safety analysis report
USAS	USA Standard
USE	upper-shelf energy
UT	ultrasonic testing
1/4 T	one fourth of the way through the vessel wall

SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a safety evaluation report (SER) on the license renewal application (LRA) for Pilgrim Nuclear Power Station (PNPS) as filed by Entergy Nuclear Operations, Inc. (ENO or the applicant). By letter dated January 25, 2006, ENO submitted its application to the United States (US) Nuclear Regulatory Commission (NRC) for renewal of the PNPS operating license for an additional 20 years. The NRC staff (the staff) prepared this report to summarize the results of its safety review of the LRA for compliance with Title 10, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," of the *Code of Federal Regulations* (10 CFR Part 54). The NRC project manager for the license renewal review is Perry Buckberg. Mr. Buckberg may be contacted by telephone at 301-415-1383 or by electronic mail at Phb1@nrc.gov. Alternatively, written correspondence may be sent to the following address:

Division of License Renewal
US Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Perry Buckberg, Mail Stop 011-F1

In its January 25, 2006, submission letter, the applicant requested renewal of the operating license issued in accordance with Section 104b (Operating License No. DPR-35) of the Atomic Energy Act of 1954, as amended, for PNPS for a period of 20 years beyond the current expiration at midnight June 8, 2012. PNPS is located approximately 4 miles southeast of Plymouth, Massachusetts. The NRC issued the construction permit for PNPS on August 26, 1968, and the operating license on September 15, 1972. PNPS employs a boiling water reactor with Mark I containment. General Electric supplied the nuclear steam supply system and Bechtel Corporation originally designed and constructed the balance of the plant. The PNPS licensed power output is 2028 megawatt thermal with a gross electrical output of approximately 690 megawatt electric. The updated final safety analysis report (UFSAR) contains details of the plant and the site.

The license renewal process consists of two concurrent reviews, a technical review of safety issues and an environmental review. The NRC regulations in 10 CFR 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 PNPS license renewal is based on the applicant's LRA and its responses to staff requests for additional information. The applicant provided supplemental information through its responses to the staff's requests for additional information in audits, meetings, and docketed correspondence. The staff reviewed and considered all information submitted through September 21, 2007. The staff reviewed information received after that date on a case by case basis depending on the stage of the safety review and the volume and complexity of the information. The public may view the LRA and all pertinent information and materials, including the UFSAR, at the NRC Public Document Room on the first floor of One White Flint North, 11555 Rockville Pike, Rockville, MD 20852-2738 (301-415-4737 / 800-397-4209), and at Plymouth Public Library, 132 South Street, Plymouth, MA 02360. In addition, the public may find the LRA, as well as materials related to the license renewal review, on the NRC website at http://www.nrc.gov.

This SER summarizes the results of the staff's safety review of the LRA and describes the technical details considered in evaluating the safety aspects of the unit's proposed operation for an additional 20 years beyond the term of the current operating license. The staff reviewed the LRA in accordance with NRC regulations and the guidance in US NRC Regulatory Guide (RG) 1.188, Revision 1, and 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 address the staff's evaluation of license renewal issues considered during the review of the LRA. SER Section 5 is reserved for the report of the Advisory Committee on Reactor Safeguards (ACRS). Section 6 presents the conclusions of this report.

SER Appendix A is a table of the applicant's commitments for renewal of the operating license. SER Appendix B is a chronology of the principal correspondence between the staff and the applicant on 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 plant-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)." This supplement discusses the environmental considerations related to the PNPS license renewal. The staff issued draft, plant-specific GEIS Supplement 29 "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Pilgrim Nuclear Power Station" in December 2006.

1.2 License Renewal Background

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

In 1982, the staff anticipated interest in license renewal and held a workshop on nuclear power plant aging. This workshop led the 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 for life extension of nuclear power plants. In 1986, the staff published a request for comment on a policy statement that would address major policy, technical, and procedural issues related to license renewal for nuclear power plants.

In 1991, the staff published the license renewal rule in 10 CFR Part 54 (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 experience necessary to develop implementation guidance. To establish a scope of review for license renewal, 10 CFR Part 54 defined age-related degradation unique to license renewal. However, during the demonstration program, the staff found that adverse aging effects on plant systems and components are managed during the period of the initial license. In addition, the staff found that the scope of the review did not allow sufficient credit for existing programs, particularly the implementation of 10 CFR 50.65 "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," which also manages plant-aging phenomena. As a result, the Commission amended 10 CFR Part 54 in 1995. As amended, 10 CFR Part 54 establishes a regulatory process simpler, more stable, and more predictable than the previous 10 CFR Part 54 process. In particular, as amended, 10 CFR Part 54 focuses on the management of adverse aging effects rather than on identifying age-related degradation unique to license renewal. These rule changes were initiated to ensure that important systems, structures, and components (SSCs) will continue to perform their intended functions during periods of extended operation. In addition, the revised 10 CFR Part 54 process clarifies and simplifies the integrated plant assessment for consistency with the revised focus on passive, long-lived structures and components (SCs).

In parallel with these initiatives, the NRC pursued a separate rulemaking effort (61 FR 28467, June 5, 1996) 10 CFR Part 51 to focus the scope of the review of license renewal environmental impacts and to fulfill the NRC's responsibilities in accordance with 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 exception 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) the failure of which could affect safety-related functions, or (3) are relied on for compliance with NRC fire protection, environmental qualification, pressurized thermal shock, anticipated transient without scram, and station blackout regulations.

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). SCs subject to an AMR perform an intended function without moving parts or without a change in configuration or properties and are not subject to replacement after a qualified life or specified time period. As required by 10 CFR 54.21(a), license renewal applicants must demonstrate that the aging effects will be managed in such a way 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 are readily detectable and can be identified and corrected through routine surveillance, performance monitoring, and maintenance. Surveillance and maintenance programs for active equipment, as well as other maintenance aspects of plant design and licensing basis, are required throughout the period of extended operation.

Pursuant to 10 CFR 54.21(d), the LRA is required to include a UFSAR supplement that must have 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 are made about the length of time the plant can operate. These assumptions are incorporated into design calculations for several plant SSCs. In accordance with 10 CFR 54.21(c)(1), the applicant must 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 developed and issued Regulatory Guide 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses." This regulatory guide endorses Nuclear Energy Institute (NEI) 95-10, Revision 6, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," which the NEI issued in June 2005. NEI 95-10 details an acceptable method of implementing 10 CFR Part 54. The staff also used the SRP-LR in reviewing 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 the aging of many SCs subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources to review the LRA 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 SCs throughout the industry. The report is also a quick reference for both the applicant and staff reviewers to AMPs and activities that can provide adequate aging management during the period of extended operation.

1.2.2 Environmental Review

Part 51 of 10 CFR governs environmental protection regulations. In December 1996, the staff revised the environmental protection regulations to facilitate environmental review for license renewal. The staff prepared NUREG-1437, Revision 1, "Generic Environmental Impact Statement for License renewal of Nuclear Plants," to document its evaluation of the possible environmental impacts of nuclear power plant license renewals. For certain environmental impacts, the GEIS establishes findings applicable to all nuclear power plants (i.e., Category 1 Issues). These generic findings 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), license renewal applicants may incorporate these generic findings in their environmental reports. Under 10 CFR 51.53(c)(3)(ii), an environmental report must also include analyses of environmental impacts that must be evaluated on a plant-specific basis (i.e., Category 2 issues).

In accordance with 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 the GEIS had not considered new and significant information. As part of its scoping process, the staff held a public meeting on May 17, 2006, in Plymouth, MA, to identify plant-specific environmental issues. Draft, plant-specific GEIS Supplement 29 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 January 24, 2007, in Plymouth, MA, to discuss draft, plant-specific GEIS Supplement 29. After considering comments on the draft, the staff will publish the final, plant-specific GEIS Supplement 29 separately from this report.

1.3 Principal Review Matters

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

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

Under 10 CFR 54.19(b), the NRC requires that LRAs 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, in the LRA the applicant stated:

> The current Indemnity Agreement (No. B-48) for PNPS 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. 12 (effective May 5, 2002), lists PNPS operating license number DPR-35. Entergy Nuclear Operations, Inc. has reviewed the original indemnity agreement and Amendments 1 through 12. Neither Article VII nor Item 3 of the attachment specify an expiration date of license number DPR-35. Therefore, no changes to the indemnity agreement are deemed necessary as part of this application. Should the license number be changed upon issuance of the renewal license, ENO requests that conforming changes be made to Item 3 of the attachment, and other sections of the indemnity agreement as appropriate.

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

Under 10 CFR 54.21, "Contents of Application - Technical Information," the NRC requires that LRAs contain (a) an integrated plant assessment, (b) a description of any CLB changes, (c) an evaluation of TLAAs, and (d) a UFSAR supplement. LRA Sections 3 and 4 and Appendix B address the license renewal requirements of 10 CFR 54.21(a) - (c). LRA Appendix A satisfies the license renewal requirements of 10 CFR 54.21(d).

Under 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 for staff review an LRA amendment identifying any CLB changes of the facility that materially affect the contents of the LRA, including the UFSAR supplement. By letter dated April 18, 2007, the applicant submitted an update to the LRA summarizing the CLB changes that had occurred during the staff's review of the LRA. This submission satisfies the requirements of 10 CFR 54.21(b) and is still under staff review.

Under 10 CFR 54.22, the NRC requires that the LRA include changes or additions to the technical specifications necessary to manage the aging effects during the period of extended operation. In LRA Appendix D, the applicant stated that it had not identified any technical specification changes necessary to support issuance of the renewed PNPS operating license. This statement adequately addresses the 10 CFR 54.22 requirement.

The technical information submitted in the LRA, as required by 10 CFR 54.21 and 22, was evaluated by the staff in accordance with NRC regulations and SRP-LR guidance. SER Sections 2, 3, and 4 document the staff's evaluation.

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 will incorporate the ACRS report when issued. SER Section 6 documents the findings required by 10 CFR 54.29, "Standards for Issuance of a Renewed License."

The final, plant-specific GEIS Supplement 29 will document the staff's evaluation of the environmental information required by 10 CFR 54.23, "Contents of Application - Environmental Information," and will specify the considerations related to the PNPS operating license renewal. The staff will prepare this supplement separately from the SER.

1.4 Interim Staff Guidance

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

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

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.	Not applicable (PWRs only)
Corrosion of drywell shell in Mark I containments **(LR-ISG-2006-01)**	To address concerns related to corrosion of drywell shell in Mark I containment.	3.5.2.2.1

1.5 Summary of Open Items

As a result of its review of the LRA, including additional information submitted to the staff through September 12, 2007, the staff identified the following open items (OIs). An item is considered open if the applicant has not presented a sufficient basis for issue resolution. Each OI has been assigned a unique identifying number.

OI 2.3.3.6: (SER Section 2.3.3.6 - Security Diesel)

LRA Table 2.3.3-6 shows the component types subject to an AMR but the security diesel system was not in the FSAR or in any license renewal drawings; therefore, the staff could not determine the portion of the security diesel system within the scope of license renewal. Additionally, the staff could not determine whether any components within the scope of license renewal were not shown as subject to an AMR.

Subsequently, the staff performed a system walkdown of the security diesel generator to verify that the licensee had accurately addressed the scoping and screening of the system in the LRA, specifically within Section 2.3.3.6, Table 2.3.3-6. The staff did not identify any deficiencies in the licensee description of the components relative to scope under 10 CFR 54.4(a)(3), and verified that except for the security diesel generator, there are no safety-related SSCs in the diesel generator enclosure or in proximity to the security diesel generator. Based on this information, the staff concludes that the applicant has correctly identified the security diesel generator system SSCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR[HSpace]54.21(a)(1), and open item (OI) 2.3.3.6 is closed.

OI 3.0.3.2.10: (SER Section 3.0.3.2.10 - Fire Protection Program)

The applicant is taking an exception to the GALL Report program element "detection of aging effects." The LRA states:

> The NUREG-1801 program states that approximately 10% of each type of penetration seal should be visually inspected at least once every refueling outage. The PNPS program specifies inspection of approximately 20% of the seals, including at least one seal of each type, each operating cycle, with all accessible fire barrier penetration seals being inspected at least once every five operating cycles.

The LRA also states that, "[s]ince aging effects typically are manifested over several years, this variation in inspection frequency is insignificant." GALL AMP XI.M26 specifies approximately 10 percent of each type of seal should be inspected visually at least every refueling outage (RFO) (2 years). The applicant clarified that the program specifies inspection of approximately 20 percent of the seals, including at least one seal of each type, each operating cycle, with all accessible fire barrier penetration seals being inspected at least once every five operating cycles. The applicant needs to address how to manage the aging effect of inaccessible fire barrier penetration seals.

In response to a committee member question regarding fire barrier penetration seals during the April 4, 2007, ACRS Subcommittee meeting, the applicant stated, "[t]here are no inaccessible seals." (Reference 4) By letter dated June 21, 2007, the applicant stated that, "[t]he PNPS requirement to inspect penetration seals applies to 100% of the seals. The word "accessible" is not necessary in the discussion of the exception for Detection of Aging Effects in the PNPS program" In LRA Appendix B, Section B.1.13.1, the word "accessible" was removed resulting in the following description of the exception for Detection of Aging Effects."

> The NUREG-1801 program states that approximately 10% of each type of penetration seal should be visually inspected at least once every refueling outage. The PNPS program specifies inspection of approximately 20% of the seals, including at least one seal of each type, each operating cycle, with all fire barrier penetration seals being inspected at least once every five operating cycles.

The applicant clarified the PNPS fire barrier penetration seal inspection program, clarified that there are no inaccessible seals, and removed the word "accessible" from Section B.1.13.1. The staff concludes that concerns identified in OI 3.0.3.2.10 have been resolved. Open Item 3.0.3.2.10 is closed.

Both GALL AMP XI.M26 and the applicant's proposed program inspect a sample of each type of seal every RFO. By inspecting approximately 20 percent of the seals each outage, the PNPS fire barrier seal inspection program will accomplish inspection of 100 percent of the penetration seals in 10 years (five operating cycles). GALL AMP XI.M26 allows inspection of 100 percent of the penetration seals over 20 years (10 operating cycles). The staff evaluated the applicant's program and determined that overall it meets or exceeds the penetration seal inspection frequency recommended in the GALL Report and it adequately addresses the aging mechanism requiring management of fire barrier penetration seals. On the basis of its review, the staff concludes that the PNPS fire barrier penetration seal inspection program is effective in finding signs of penetration seal degradation during the period of extended operation. The staff is adequately assured that the fire barrier penetration seals will be considered appropriately during plant aging management activities and will continue to perform applicable intended functions consistent with the CLB for the period of extended operation.

OI 3.0.3.3.2: (SER Sections 3.0.3.3.2 - Containment Inservice Inspection and 3.5.2.2.1 - PWR and BWR Containments)

Recent inspection team observations indicated the following:

- The flow switch in the bellows rupture drain had failed its surveillance in December 2005 and has not been fixed or evaluated. In addition, the flow switch also failed in 1999.
- Monitoring of other drains has been inconclusive and not well documented.
- The torus room floor has had water on the floor on multiple occasions.

In Request for Additional Information (RAI) B.1.16.1, dated November 7, 2006, the applicant was asked to address the above finding and discuss the impact on the aging management of potential loss of material due to corrosion in the inaccessible area of the Mark I steel containment drywell shell, basemat, including the sand pocket region for the period of extended operation.

In response to RAI B.1.16.1, the applicant: stated that it had established a new preventive maintenance task to replace the flow switch and will continue functional checks each RFO outage; described the monitoring and documentation of the bellows rupture drain and other drains; identified the source of water on the torus floor as groundwater that has no relation to the failed flow switch and drain monitoring inspection findings and has no impact on drywell shell corrosion in general; showed that water intrusion into the torus room will not detrimentally affect the structure; and, identified monitoring programs that both inspect torus bolts and test water for aggressiveness. The staff finds the applicant's actions acceptable and concludes that concerns identified in OI 3.0.3.3.2 have been resolved. OI 3.0.3.3.2 is closed.

OI 4.2: (SER Sections 3.0.3.2.15 - Reactor Vessel Surveillance Program, 4.2 - Reactor Vessel Neutron Embrittlement, 4.7.1 - Reflood Thermal Shock of the Reactor Vessel Internals, and 4.7.2.1 BWRVIP-05, Reactor Vessel Circumferential Welds).

Due to the lack of benchmarking data in support of the plant-specific RAMA fluence calculations, the staff found neutron fluence values unacceptable for use in the reactor vessel (RV) neutron embrittlement TLAAs.

In a letter dated June 21, 2007, the applicant provided a calculated limiting fluence value for each TLAA. The limiting value, 3.37×10^{18} n/cm^2 (E > 1.0 MeV) for the lower intermediate shell axial welds at the RV inner surface, will be compared to actual RV fluence values from the reactor once the fluence calculation benchmarking issue is resolved. The applicant committed to: Ensure resolution of the fluence calculation benchmarking issue (Commitment No. 47), and confirm that the calculated limiting fluence will not be reached at the end of the period of extended operation and that all of the fluence-dependant TLAA remain valid (Commitment No. 48).

The staff reviewed and evaluated the applicant's limiting fluence calculations by performing independent calculations. The staff's calculations confirmed the applicant's results. The staff found that the applicant correctly concluded that the limiting fluence for all fluence-dependant TLAAs is 3.37×10^{18} n/cm^2 (E > 1.0 MeV) based on the TLAA for the RV axial weld conditional failure probability because it is the lowest value of the maximum allowable 54 EFPY fluence for all fluence-dependant TLAAs.

The staff issued License Condition 4.2.6: On or before June 8, 2010, the applicant (Entergy) will submit to the NRC correctly benchmarked RV neutron fluence calculations, consistent with RG 1.190, that will confirm that the neutron fluence for the lower intermediate shell axial welds, at the inner surface of the RV, will not reach the limiting value of 3.37×10^{18} n/cm^2 (E > 1.0 MeV) by the end of the period of extended operation (54 EFPY).

The staff finds that a suitable means has been established for conclusively confirming that all fluence-dependent TLAAs will remain valid when acceptable fluence data becomes available prior to the beginning of the period of extended operation. The staff concludes that OI 4.2 is closed.

1.6 Summary of Confirmatory Items

As a result of its review of the LRA, including additional information submitted to the staff through June 21, 2007, the staff determined that no confirmatory items exist which would require a formal response from the applicant.

1.7 Summary of Proposed License Conditions

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

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

The second license condition requires future activities identified in the UFSAR supplement to be completed prior to the period of extended operation.

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. All capsules placed in storage must be maintained for future insertion. Any changes to storage requirements must be approved by the staff, as required by 10 CFR Part 50, Appendix H.

The fourth license condition, identified as License Condition 4.2.6, requires that on or before June 8, 2010, the applicant will submit to the NRC correctly benchmarked RV neutron fluence calculations, consistent with RG 1.190, that will confirm that the neutron fluence for the lower intermediate shell axial welds, at the inner surface of the RV, will not reach the limiting value of 3.37×10^{18} n/cm^2 (E > 1.0 MeV) by the end of the period of extended operation (54 EFPY).

SECTION 2

STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 Scoping and Screening Methodology

2.1.1 Introduction

Title 10, Section 54.21 of the *Code of Federal Regulations* (10 CFR Part 54.21), "Contents of Application – Technical Information," requires for each license renewal application (LRA) an integrated plant assessment (IPA) listing structures and components (SCs) subject to an aging management review (AMR) from all of the systems, structures, and components (SSCs) within the scope of license renewal.

LRA Section 2.1, "Scoping and Screening Methodology," describes the methodology for identifying SSCs at the Pilgrim Nuclear Power Station (PNPS) within the scope of license renewal and SCs subject to an AMR. The staff reviewed the Entergy Nuclear Operations, Inc. (ENO or the applicant) scoping and screening methodology to determine whether it meets the scoping requirements of 10 CFR 54.4(a) and the screening requirements of 10 CFR 54.21.

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

2.1.2 Summary of Technical Information in the Application

LRA Sections 2 and 3 state the technical information required by 10 CFR 54.21(a). LRA Section 2.1 describes the process for identifying SSCs meeting the license renewal scoping criteria of 10 CFR 54.4(a) and the process for identifying SCs subject to an AMR as required by 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"
- Section 2.4, "Scoping and Screening Results: Structures"
- Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Control Systems"

LRA Section 3, "Aging Management Review Results," states the applicant's aging management results in the following LRA sections:

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

LRA Section 4, "Time-Limited Aging Analyses," states the applicant's 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 in Section 2.1, NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," Revision 1, (SRP-LR), and the Nuclear Energy Institute (NEI) 95-10, "Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," Revision 6, (NEI 95-10). The following regulations form the basis for the acceptance criteria for the scoping and screening methodology review:

- 10 CFR 54.4(a) as to identification of plant SSCs within the scope of the Rule
- 10 CFR 54.4(b) as to identification of the intended functions of plant systems and structures within the scope of the Rule
- 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2) as to the methods utilized by the applicant to identify plant SCs subject to an AMR

With the guidance of the corresponding SRP-LR sections, the staff reviewed, as part of the applicant's scoping and screening methodology, the activities described in the following LRA sections:

- Section 2.1 to ensure that the applicant described a process for identifying SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)
- Section 2.2 to ensure that the applicant described a process for identifying SCs subject to an AMR in accordance with 10 CFR 54.21(a)(1) and 10 CFR 54.21(a)(2)

The staff conducted a scoping and screening methodology audit at PNPS in Plymouth, Massachusetts, during the week of June 6 through 9, 2006. The audit focused on whether the applicant had developed and implemented adequate guidance for the scoping and screening of SSCs by the methodologies in the LRA and the requirements of the Rule. The staff reviewed implementation of PNPS license renewal project reports (LRPDs) and license renewal project guidelines (LRPGs) describing the applicant's scoping and screening methodology. The staff discussed with the applicant details of 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 reviewed the applicant's processes for quality assurance (QA) for development of the LRA. The staff reviewed the quality attributes of the applicant's aging management program (AMP) activities described in LRA Appendix A, "Updated Final Safety Analysis Report Supplement," and LRA Appendix B, "Aging Management Programs and Activities," and the training and qualification of the LRA development team. The staff reviewed scoping and screening results reports for the reactor core isolation cooling (RCIC) system and the yard structures for the applicant's appropriate implementation of the methodology outlined in the administrative controls and for results 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 audit report dated September 15, 2006, to verify whether the process for identifying SCs subject to an AMR was consistent with the LRA and the SRP-LR. Additionally, the staff reviewed the scope of CLB documentation sources and the applicant's process for appropriate consideration of CLB commitments and for adequate implementation of the procedural guidance during the scoping and screening process.

2.1.3.1.1 Summary of Technical Information in the Application

In LRA Section 2.1.1, "Scoping Methodology," and LRA Section 2.1.2, "Screening Methodology," the applicant addressed the following information sources for the license renewal scoping and screening process:

- q-list
- maintenance rule scoping documents
- system design basis documents (DBDs)
- updated final safety analysis report (UFSAR)
- engineering drawings (*i.e.*, piping and instrumentation drawings (P&IDs)) and evaluations
- other station documents (*e.g.*, license renewal project guidelines)
- NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," Revision 6
- fire hazards analysis report

The applicant stated that this information identified the functions of plant systems and structures. The applicant then compared these functions to the 10 CFR 54(a)(1-3) scoping criteria to determine whether the plant systems or structures performed license renewal intended functions, used these sources to list SCs subject to an AMR, and identified the SCs subject to AMR with color highlighting on the license renewal boundary drawings (LRBDs).

The LRBDs show the systems within the scope of license renewal highlighted in color.

2.1.3.1.2 Staff Evaluation

Scoping and Screening Implementation Procedures. The staff reviewed the following scoping and screening methodology implementation procedures: LRPGs, LRPDs, AMR reports (AMRMs for mechanical, AMREs for electrical, and AMRCs for structural), as documented in the audit report, for consistency with the requirements of the Rule, the staff's SRP, and the guidance of Nuclear Energy Institute (NEI) 95-10.

The staff found in the LRPGs, LRPDs and AMRs the overall process for implementing 10 CFR Part 54 requirements, guidance for identifying plant SSCs within the scope of the Rule and SC component types within the scope of license renewal subject to an AMR. The staff's review focused on the consistency of the detailed procedural guidance with information in the LRA reflecting implementation of staff positions in the SRP-LR and in interim staff guidance (ISG) documents.

After reviewing the LRA and supporting documentation, the staff finds LRA Section 2.1 consistent with the scoping and screening methodology instructions. The applicant's methodology has sufficiently detailed guidance for the scoping and screening implementation process followed in the LRA.

Sources of CLB Information. For PNPS, system safety functions are stated in safety classification documents, the maintenance rule SSC basis documents for each system, and in DBDs for systems for which DBDs were written. The staff considered the safety objectives in the UFSAR system descriptions and identified objectives meeting the safety-related criterion of 10 CFR 54.4(a)(1) as system intended functions.

The staff reviewed the scope and depth of the applicant's CLB information to verify whether the applicant's methodology had identified all SSCs within the scope of license renewal as well as component types requiring AMRs. As defined in 10 CFR 54.3(a), the CLB is the set of applicable NRC requirements and written licensee commitments for ensuring compliance with, and operation within, applicable NRC requirements, and plant-specific design bases docketed and in effect. The CLB includes NRC regulations, orders, license conditions, exemptions, technical specifications, design-basis information in the most recent UFSAR, and licensee commitments in docketed correspondence like licensee responses to NRC bulletins, generic letters, and enforcement actions as well as commitments in NRC safety evaluations or licensee event reports.

During the audit, the staff reviewed the applicant's information sources and samples of such information, including the UFSAR, plant system DBDs, license renewal flow diagrams, and maintenance rule information. In addition, the applicant's license renewal process produced licensing correspondence, the fire hazards analysis, safety evaluations, design documentation (*e.g.*, engineering calculations and design specifications), and other sources of plant information pertinent to the scoping and screening process. The staff verified that the applicant's detailed LRPGs required CLB source information for scoping evaluations.

During the staff's review of the applicant's CLB evaluation process, the applicant discussed with the staff the incorporation of CLB updates into the license renewal process. As part of this effort, the applicant examined all engineering change requests implemented as of four months before the LRA submission, factored in all changes that could affect the LRA, and developed guidance for the evaluation of CLB changes that could impact the LRA. The guidance describes the process so the LRA adequately documents the results.

The staff determined that LRA Section 2.1 description of the CLB and related documents used during the scoping and screening process is consistent with SRP-LR guidance. The staff also reviewed technical reports identifying SSCs relied upon for compliance with the safety-related criteria, nonsafety-related criteria, and regulated events criteria, as specified in 10 CFR 54.4(a). The applicant's license renewal program guidelines comprehensively listed documents that support scoping and screening evaluations. The staff found these design documentation sources useful for ensuring that the applicant's initial scope of SSCs was consistent with the plant's CLB.

2.1.3.1.3 Conclusion

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

2.1.3.2 Quality Controls Applied to LRA Development

2.1.3.2.1 Staff Evaluation

The staff reviewed the applicant's quality controls for whether LRA scoping and screening methodologies were implemented adequately. The applicant utilized the following processes:

- Implementation of the scoping and screening methodology by written procedures
- Study of previous staff requests for additional LRA information for whether the LRA addressed applicable issues
- LRA examination by the Offsite and Onsite Safety Review Committees before its submission
- An industry peer review of the LRA
- An independent LRA examination by the applicant's QA organization for whether the technical information for the LRA was updated and approved in accordance with the station's QA program and whether industry peer and Offsite and Onsite Safety Review Committee issues had been resolved and corrective actions implemented.

2.1.3.2.2 Conclusion

Based on its review of pertinent LRA development guidance, discussion with the applicant's license renewal personnel, and review of the quality audit reports, the staff concludes that these QA activities add assurance that LRA development activities have been according to LRA descriptions.

2.1.3.3 Training

2.1.3.3.1 Staff Evaluation

The staff reviewed the applicant's training process for consistent and appropriate guidelines and methodology for the scoping and screening activities.

The LRPGs specified requirements for reading training material and attending training sessions, for the license renewal project team and site personnel. The LRPG attachment specified the level of training required for the various groups developing the LRA beginning with initial training documented on a qualification card. The training was required for both the license renewal project personnel who prepared and the site personnel who reviewed the application. License renewal refresher training for participating project team and site personnel included information on the license renewal process and information specific to the site. License renewal personnel were required to study applicable license renewal regulations, NEI 95-10, and associated procedures. In periodic production meetings the license renewal project team members shared their knowledge and experience.

The staff examined completed qualification and training records of several of the applicant's license renewal personnel and also examined completed check lists. The staff made no adverse findings. After discussions with the applicant's license renewal personnel during the audit, the staff verified that they were knowledgeable about license renewal process requirements and specific technical issues within their areas of responsibility.

2.1.3.3.2 Conclusion

Based on discussions with the applicant's license renewal personnel responsible for the scoping and screening process and review of selected documentation supporting the process, the staff concludes that the applicant's personnel understood the requirements and adequately implemented the scoping and screening methodology documented in the LRA. The staff concludes that the license renewal personnel were adequately trained and qualified for license renewal activities.

2.1.3.4 Conclusion of Scoping and Screening Program Review

Based on its review of LRA Section 2.1, review of the applicant's detailed scoping and screening implementation procedures, discussions with the applicant's LRA personnel, and review of the scoping and screening audit results, the staff concludes that the applicant's scoping and screening program is consistent with SRP-LR and NEI 95-10 guidance and, therefore, is acceptable.

2.1.4 Plant Systems, Structures, and Components Scoping Methodology

LRA Section 2.1.1, describes the methodology for scoping SSCs pursuant to 10 CFR 54.4(a) and the plant scoping process for systems and structures.

The applicant described the scoping process for the plant in terms of systems and structures. Specifically, the scoping process listed plant systems and structures and stated their intended functions, which are the bases for including systems or structures within the scope of license renewal (as defined in 10 CFR 54.4(b)) identified by comparison of the system or structure function with 10 CFR 54.4(a) criteria. The plant systems list was developed from CLB source information and the structures list from plant layout drawings. Finally, the applicant evaluated the system and structure components within the scope of license renewal and depicted the in-scope system boundaries of structures and components subject to an AMR on the license renewal drawings. The applicant's scoping methodology, as described in the LRA, is addressed in the following sections.

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

2.1.4.1.1 Summary of Technical Information in the Application

LRA Section 2.1.1.1 describes the scoping methodology required for safety-related criteria by 10 CFR 54.4(a)(1). Regarding the safety-related criteria, the applicant stated that systems and structures that perform safety functions as defined in 10 CFR 54.4(a)(1) are within the scope of license renewal. According to the applicant, PNPS maintains a quality classification list (*i.e.* PNPS q-list) to comply with 10 CFR Part 50, Appendix B and identify SSCs in the quality assurance program. The q-list describes the system and structure functions that require classification of SSCs as safety-related. The SSCs within the functional class breaks depicted on the plant drawings (i.e. piping and instrumentation diagrams (P&IDs)) constitute the q-list. These functional Class 1 breaks appear only on P&IDs; thus, the determination of safety-related systems and structures for the LRA was based on the q-list supplemented by maintenance rule scoping documentation, system design basis documentation, and the UFSAR.

The PNPS CLB definition of "safety-related" is not identical to that in the Rule so the applicant evaluated the differences between the current CLB definition of "safety-related" and the Rule definition. The PNPS definition of an SSC as safety-related is equivalent to that in 10 CFR 54.4 except that only 10 CFR Part 100 is cited for dose guidelines for 10 CFR 54.4(a)(1)(iii) criteria, which refer to the 10 CFR 50.34(a)(1) and 10 CFR 50.67(b)(2) dose guidelines applicable to facilities seeking construction permits or revising the accident source terms in their design basis radiological analyses, and is not applicable to PNPS.

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 (RCPB), (b) the ability to shut down the reactor and maintain it in a safe shutdown condition, or (c) the ability to prevent or mitigate the consequences of accidents that could cause offsite exposures comparable to those of 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11.

As 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 UFSAR. Examples of DBEs that may not be described in this chapter include external events, such as floods, storms, earthquakes, tornadoes, or hurricanes, and internal events, such as a high energy line break. Information regarding DBEs as defined in 10 CFR 50.49(b)(1) may be found in any chapter of the facility UFSAR, the Commission's regulations, NRC orders, exemptions, or license conditions within the CLB. These sources should also be reviewed to identify SSCs relied upon to remain functional during and following DBEs (as defined in 10 CFR 50.49(b)(1)) to ensure the functions described in 10 CFR 54.4(a)(1).

The staff's review of LRA Section 2.1 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening methodology. The applicant responded to the staff's requests for additional information (RAIs) as discussed below.

In RAI 2.1-1 dated July 25, 2006, the staff stated that during the scoping and screening methodology audit it had asked how non-accident DBEs, particularly DBEs not described in the UFSAR/updated safety analysis report (USAR), had been considered during scoping. The staff noted that limiting consideration of DBEs to those described in the UFSAR/USAR could omit safety-related functions described in the CLB. Therefore, the staff requested a list of DBEs evaluated in the license renewal scoping process and a description of the methodology for addressing all DBEs (including conditions of normal operation, anticipated operational occurrences, design-basis accidents (DBAs), external events, and natural phenomena) during license renewal scoping.

In its response dated August 22, 2006, the applicant described the DBEs evaluated for license renewal and the methodology for addressing all DBEs during license renewal scoping. Specifically, the applicant identified abnormal operational transients, DBAs, and additional external events and natural phenomena (*e.g.*, flooding, earthquakes, high winds) as PNPS DBEs.

In addition, the applicant described two basic means of addressing all plant DBEs during the license renewal scoping process: (1) study of the UFSAR and DBDs (*i.e.*, for external and internal events and safety analyses) for the DBEs and for the SSCs credited for each event and (2) evaluation of the safety classification of systems and components by the plant safety classification process. These means ensure consideration of site-specific procedures, design-basis information, regulatory commitments, and regulatory guidance during the classification process that identified SSCs credited for performance of 10 CFR 54.4(a)(1) intended safety functions.

The staff reviewed a sample of the DBD sources of this information and found a concise and detailed evaluation of events with appropriate CLB documentation references to support the review and a resultant matrix of systems and structures relied upon to remain functional during and following these DBEs. The staff concluded that the applicant had considered a scope of DBEs consistent with the SRP-LR.

Based on its review, the staff finds the applicant's response to RAI 2.1-1 acceptable because the additional information provided: (1) a detailed listing of the DBEs for the plant, (2) a description of the design and configuration control processes identifying SSCs credited for DBE mitigation, and (3) a description of the processes and sources of DBE information for the scoping evaluation consistent with 10 CFR 54.4(a)(1), and the staff's concern described in RAI 2.1-1 is resolved.

The applicant's scoping of SSCs under 10 CFR 54.4(a)(1) was in accordance with LRPGs for the preparation, review, verification, and approval of the scoping evaluations for adequate scoping results. The staff reviewed these guidance documents for the applicant's evaluation of safety-related SSCs and sampled the applicant's scoping results reports for implementation of the methodology in accordance with those instructions. In addition, the staff discussed the methodology and results with the applicant's personnel responsible for the evaluations.

Specifically, the staff reviewed a sample of license renewal scoping results for several mechanical systems (*e.g.*, core spray, salt service water (SSW), RCIC) and structural components (*e.g.*, trenches, valve pits, manhole, duct bank) for additional assurance of adequate implementation of the applicant's 10 CFR 54.4(a)(1) scoping methodology. The staff verified scoping results for each of the sampled systems consistent with the methodology, identification of SSCs credited for performing intended functions, and adequate descriptions of the bases for the results as well as the intended functions. The staff confirmed the applicant's use of pertinent engineering and licensing information to identify SSCs required to be within the scope of license renewal by 10 CFR 54.4(a)(1).

To help identify SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a), the applicant's scoping process listed plant systems and structures and their intended functions that are the bases for including them within the scope of license renewal (as defined in 10 CFR 54.4(b)) and that are identified by comparison with 10 CFR 54.4(a)(1) criteria. The applicant identified these functions from applicable plant licensing and design documentation, including UFSAR sections, maintenance rule scoping documents, the q-list, the fire hazards analysis, the 10 CFR Part 50, Appendix R, safe shutdown analysis, technical specifications, system DBDs, and topical DBDs.

The staff reviewed the safety classification criteria for consistency between the CLB definition and the rule definition. In addition, the staff reviewed the applicant's evaluation of the differences between the rule definition and the site-specific definition of "safety-related" for whether all SSCs meeting 10 CFR 54.4(a)(1) requirements had been addressed adequately. The applicant documented this evaluation in the LRA and LRPGs. The applicant stated that the site-specific definition for "safety-related" was nearly identical to the rule definition with the following exception:

> The CLB definition regarding potential off-site exposure limits refers to 10 CFR Part 100 whereas the rule also references comparable guidelines in 10 CFR 50.34(a)(1) and 10 CFR 50.67(b)(2), and 10 CFR Part 100 respectively.

The staff verified the 10 CFR 50.34(a)(1) reference; the 10 CFR 50.34(a)(1)(ii) dose limits only pertain to applicants for construction permits who apply on or after January 10, 1997. This information, if applicable, could have impacted the designation of components as safety-related and nonsafety-related. In addition, 10 CFR 54.4(a)(1)(iii) references the dose guidelines of 10 CFR 50.34(a)(1)(i) and 10 CFR 50.67(b)(2). The applicant stated that these guidelines are applicable to facilities seeking a construction permit or facilities which have revised the current accident source term used in their design basis radiological analyses, respectively, and are not applicable to PNPS.

The staff verified that the applicant has not amended its operating license to allow use of an alternative source term for accident analyses. In addition, the staff reviewed the applicant's evaluation, discussed its results with the applicant's license renewal team members, and determined that the applicant had evaluated differences between the PNPS safety-related definition and the rule definition adequately and that they did not cause any additional components beyond those identified in the CLB to be considered safety-related.

2.1.4.1.3 Conclusion

Based on this sample review, discussions with the applicant, and review of the applicant's scoping process, the staff determines that the applicant's methodology for identifying systems and structures meets 10 CFR 54.4(a)(1) scoping criteria and, therefore, is acceptable.

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

2.1.4.2.1 Summary of Technical Information in the Application

LRA Section 2.1.1.2 describes the scoping methodology for 10 CFR 54.4(a)(2) nonsafety-related criteria. The applicant evaluated the SSCs meeting 10 CFR 54.4(a)(2) using three categories summarily described here:

(1) Nonsafety-related SSCs required for functions that support safety-related system intended functions

The SSCs required for functions supporting safety-related components were classified as safety-related and included within the 10 CFR 54.4(a)(1) scope of license renewal. The applicant studied engineering and licensing documents (UFSAR, maintenance rule scoping documents, and DBDs) for exceptions included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

(2) Nonsafety-related systems connected to and structurally supporting safety-related SSCs

The applicant identified outside of the safety-class pressure boundary certain nonsafety-related components and piping which must be structurally sound to maintain the pressure boundary integrity of safety-related piping. These components perform structural support functions.

For piping in this structural boundary, pressure integrity is not required (except for spatial interaction between nonsafety-related and safety-related SSCs); however, piping within the safety-class pressure boundary depends on the structural boundary piping and supports for the system to fulfill its safety function. For PNPS, the "structural boundary" is defined as the portion of a piping system outside the safety-class pressure boundary yet relied upon for structural support. Nonsafety-related piping systems connected to safety-related systems were included up to the structural boundary or to a point with an adequate portion of nonsafety-related piping to include the first seismic anchor, defined as hardware or structures that, as required by the analysis, physically restrain forces and moments in three orthogonal directions, or combination of hardware or structures equivalent to a seismic anchor. The physical arrangement, as analyzed, ensures that the stresses developed in the safety-related piping and supports are within applicable piping and structural code acceptance limits. If isometric drawings of the structural boundary were not readily available, connected lines were included to a point beyond the safety-related/nonsafety-related interface (*e.g.*, a base-mounted component, a flexible connection, a drain line or the end of a piping run). The LRA states that the approach was consistent with NEI 95-10, Appendix F.

(3) Nonsafety-related systems with potential for spatial interaction with safety-related SSCs

The applicant considered physical impact, fluid leakage, and spray or flooding when evaluating potential spatial interaction between nonsafety-related systems and safety-related SSCs. For scoping of nonsafety-related systems with potential spatial interaction with safety-related SSCs, the applicant used a spaces approach focused on the interaction between nonsafety-related and safety-related SSCs located in the same spaces. A "space" was defined as a room or cubicle separated from other areas by substantial objects (*e.g.*, wall, floors, or ceilings) with any potential interaction between nonsafety-related and safety-related SSCs limited to the space.

<u>Physical Impact</u>. The applicant evaluated missiles which could be generated from failures of rotating equipment, nonsafety-related features that protect safety-related SCs from missiles, and overhead handling systems, the structural failure of which could damage any system, and from other internal, or external, events that could prevent the accomplishment of a safety function. Nonsafety-related equipment determined to have possible impact on safety-related SSCs was included within the scope of license renewal.

The applicant evaluated nonsafety-related portions of high-energy lines in the UFSAR and relevant DBDs for nonsafety-related portions high-energy lines that can affect safety-related equipment. If the applicant's high-energy line break (HELB) analysis assumed that a nonsafety-related piping system did not fail or assumed failure only at specific locations, that piping system (piping, equipment, and supports) was included within the scope of license renewal.

<u>Fluid Leakage, Spray, and Flooding</u>. The applicant evaluated moderate- and low-energy systems with the potential for spatial interactions of spray and leakage. Nonsafety-related systems and nonsafety-related portions of safety-related systems with the potential for spray or leakage that could prevent safety-related SSCs from performing required safety functions were considered within the scope of license

renewal. In addition, the nonsafety-related supports for nonsafety-related piping systems with a potential for spatial interaction with safety-related SSCs were included within the scope of license renewal.

The applicant determined that operating experience indicates no failures from aging of nonsafety-related components containing only air or gas with impact on the ability of safety-related equipment to perform required safety functions and that there are no aging effects requiring management for these components when the environment is dry gas. Systems containing only air or gas were not included within the scope of license renewal based on the potential for spray or leakage.

Whip restraints, spray shields, supports, missile or flood barriers (which can prevent physical impact and fluid leakage, spray, or flooding) and other protective features installed to protect safety-related SSCs against spatial interaction with nonsafety-related SSCs and credited in the plant design were included within the scope of license renewal.

2.1.4.2.2 Staff Evaluation

Pursuant to 10 CFR 54.4(a)(2), the applicant must consider all nonsafety-related SSCs the failure of which could prevent satisfactory performance of safety-related SSCs relied upon to remain functional during and following a DBE to ensure (a) the integrity of the RCPB, (b) the ability to shut down the reactor and maintain it in a safe shutdown condition, or (c) the ability to prevent or mitigate the consequences of accidents that could cause offsite exposures comparable to those of 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11.

NRC Regulatory Guide (RG) 1.188, Revision 1, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," dated September 2005, endorses NEI 95-10, Revision 6, as a method for compliance with 10 CFR Part 54 in preparing license renewal applications. NEI 95-10, Revision 6, addresses the staff positions 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, nonsafety-related SSCs connected to safety-related SSCs, nonsafety-related SSCs in proximity of safety-related SSCs, and the mitigative and preventive options in nonsafety-related and safety-related SSCs interactions.

The staff states that applicants should not consider hypothetical failures, but rather base their evaluation on the plant's CLB, the staff's engineering judgement and analyses, and relevant operating experience (all documented plant-specific and industry-wide experience useful in determining the plausibility of a failure). Documentation would include NRC generic communications and event reports, plant-specific condition reports, industry safety operational event reports, and engineering evaluations.

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," describing the scoping methodology for 10 CFR 54.4(a)(2) nonsafety-related criteria. The applicant evaluated SSCs under 10 CFR 54.4(a)(2) using three categories (nonsafety-related SSCs required to perform functions that support safety-related SSC intended functions, nonsafety-related systems connected to and structurally supporting safety-related SSCs, and nonsafety-related systems with a potential for spatial interaction with safety-related SSCs). In addition, the staff reviewed the PNPS LRPD (the 10 CFR 54.4(a)(2) project report), documented in the audit report, describing the AMR of nonsafety-related systems and components affecting safety-related systems. The applicant evaluated 10 CFR 54.4(a)(2) SSCs using the three categories from the NRC guidance and in accordance with NEI 95-10, Revision 6 on identification and treatment of such SSCs. The evaluations of each of the categories are detailed:

(1) Nonsafety-Related SSCs Required for Functions that Support Safety-Related SSCs - Nonsafety-related SSCs required to support safety-related functions had been classified previously as safety-related in the equipment database; therefore the nonsafety-related SSCs required to support safety-related functions had been included within the scope of license renewal as safety-related in accordance with 10 CFR 54.4(a)(1). This evaluative criterion was addressed in the applicant's 10 CFR 54.4(a)(2) project report. The single exception to this approach was the main condenser and main steam isolation valve (MSIV) leakage pathway, which was classified as a nonsafety-related system required to support a safety-related function. This system was included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff finds that the applicant implemented an acceptable method for scoping of nonsafety-related systems that support safety-related intended functions.

(2) Nonsafety-Related Systems Connected to and Structurally Supporting Safety-Related SSCs - The applicant's analysis had identified nonsafety-related SSCs outside of the safety-related pressure boundary required to be structurally sound to maintain the integrity of the safety-related SSCs. This collection of nonsafety-related and safety-related SSCs was the "structural boundary" typically shown on plant isometric drawings. The applicant had included all nonsafety-related SSCs within the analyzed structural boundary within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). If the structural boundary was not shown on the applicable isometric drawing, the applicant identified the portion of the nonsafety-related SSCs beyond the safety-related SSCs to the first seismic or equivalent anchor and included this portion within the scope of license renewal. The LRA defines the term "equivalent anchor" as a combination of hardware or structures equivalent to a seismic anchor (defined as hardware or structures that, as required by analysis, physically restrain forces and moments in three orthogonal directions). The LRA also indicates that, if the structural boundary could not be identified for the nonsafety-related/safety-related interface, the nonsafety-related SSCs were included to a point beyond the nonsafety-related/ safety-related interface to a base-mounted component, flexible connection, or an end of the piping run in accordance with the guidance of NEI 95-10, Appendix F, which describes the use of "bounding criteria" to determine the portion of nonsafety-related SSCs to be included within the scope of license renewal.

The staff's review of LRA Section 2.1.1.2 found an area in which additional information was necessary to complete the review. The applicant responded to the staff's RAI as discussed below.

The staff could not determine whether equivalent anchors (*e.g.*, a combination of supports in the three orthogonal directions) had been used in addition to the bounding criteria (base-mounted component, flexible connection, or end of piping run) as addressed in the LRA and the 10 CFR 54.4(a)(2) project report (which describes the AMR of nonsafety-related systems and components affecting safety-related systems). In

RAI 2.1-2 dated July 25, 2006, the staff requested additional information on the method used to develop the structural boundary, and asked whether equivalent anchors had been used in addition to the bounding criteria addressed in the LRA.

In its response dated August 22, 2006, the applicant further described the process used to determine the structural boundaries for nonsafety-related systems providing limited structural support to safety-related systems. As part of the applicant's determination, isometric drawings of plant piping systems were examined where appropriate for the location of structural boundaries. These isometric drawings were developed in the plant design process from piping stress analysis results. No new analysis or isometric drawings were developed for the license renewal process. Rather, the applicant used existing drawings and analysis to develop the structural boundaries and, where isometric drawings were not readily available, the bounding criteria in NEI 95-10 to identify the nonsafety-related system portions necessary to support intended functions.

As to the use of equivalent anchors, the applicant stated that, other than the actual structural boundaries identified from the piping stress analysis, isometric drawings, and the bounding criteria, it used no equivalent anchors to identify the structural boundaries for nonsafety-related systems with 10 CFR 54.4(a)(2) functions.

Based on its review, the staff finds the applicant's response to RAI 2.1-2 acceptable because the applicant described in detail the process for identifying the structural boundaries and confirmed that equivalent anchors were not used to identify structural boundaries for nonsafety-related systems with 10 CFR 54.4(a)(2) functions; therefore, the staff's concern described in RAI 2.1-2 is resolved.

(3) Nonsafety-related systems with potential for spatial interaction with safety-related SSCs. The applicant considered physical impact, fluid leakage, and spray or flooding when evaluating the potential for spatial interaction between nonsafety-related systems and safety-related SSCs. For scoping of nonsafety-related systems with potential spatial interaction with safety-related SSCs the applicant used a spaces approach focusing on the interaction between nonsafety-related and safety-related SSCs located in the same spaces. A "space" was defined as a room or cubicle separated from other areas by substantial objects such as walls, floors and ceilings. The space was defined such that any potential interaction between nonsafety-related and safety-related SSCs is limited to the space.

The 10 CFR 54.4(a)(2) project report states that the applicant evaluated situations where missiles could be generated from failure of rotating equipment and other internal or external events. The nonsafety-related design features that protect safety-related SSCs from such missiles are within the scope of license renewal. The 10 CFR 54.4(a)(2) project report also states that the applicant evaluated overhead-handling systems, the structural failure of which could damage any system and prevent the accomplishment of a safety function. Nonsafety-related overhead-handling equipment with possible impact on safety-related SSCs were included within the scope of license renewal.

The LRA states that the applicant evaluated nonsafety-related portions of high-energy lines in the UFSAR and relevant DBDs. As stated in the 10 CFR 54.4(a)(2) project report, the applicant used these references to evaluate the high-energy lines for postulated pipe breaks and identified eleven systems inside and five systems outside the reactor building. The applicant's high-energy systems were evaluated for component parts of nonsafety-related high-energy lines that can affect safety-related equipment. If the applicant's HELB analysis assumed that a nonsafety-related piping system did not fail, or failed only at specific locations, then that piping system (piping, equipment, and supports) was included within the scope of license renewal. Many of the identified systems were safety-related and included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). The remaining nonsafety-related high-energy lines with potential interaction with safety-related SSCs were included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The applicant evaluated moderate- and low-energy systems with potential for spatial interactions of spray and leakage. Nonsafety-related systems, and nonsafety-related portions of safety-related systems with potential for spray or leakage, that could prevent safety-related SSCs from performing required safety functions were considered to be within the scope of license renewal.

The 10 CFR 54.4(a)(2) project report states that the applicant used a "spaces" approach to identify the nonsafety-related SSCs located within the same spaces as safety-related SSCs. A "space" was defined as a room or cubicle separated by walls, floors, and ceilings. As noted in the audit report, the applicant documented the evaluation of each mechanical system for potential spatial interaction with safety-related SSCs in its scoping results report. After identifying the mechanical systems, the applicant considered whether the system contained fluid, air, or gas. Nonsafety-related SSCs containing air or gas were excluded from the scope of license renewal. Liquid-filled systems with components located within safety-related structures then were reviewed to determine if they had components within spaces containing safety-related SSCs. In certain instances the applicant then walked-down the mechanical systems to identify whether components are located within a safety-related structure. Nonsafety-related SSCs containing fluid and located within spaces containing safety-related SSCs were included within the scope of license renewal.

Whip restraints, spray shields, supports, missile or flood barriers (which can prevent physical impact and fluid leakage, spray, or flooding), and other protective features installed to protect safety-related SSCs against spatial interaction with nonsafety-related SSCs and credited in the plant design were included within the scope of license renewal.

2.1.4.2.3 Conclusion

Based on its review, the staff determines that the applicant's methodology for identifying systems and structures meets 10 CFR 54.4(a)(2) scoping criteria and, therefore, is acceptable. This determination is based on a review of sample systems, discussions with the applicant, and review of the applicant's scoping process.

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

2.1.4.3.1 Summary of Technical Information in the Application

LRA Section 2.1.1.3, "Application of Criterion for Regulated Events," describes the methodology for identifying systems and structures within the scope of license renewal. Mechanical systems and structures with fire protection (FP), anticipated transient without scram (ATWS), Environmental Qualification (EQ), or station blackout (SBO) intended functions were included within the scope of license renewal. Mechanical systems and structures with intended functions for 10 CFR 54.4(a)(3) are identified in LRA Sections 2.3 and 2.4. All plant electrical, instrumentation and control (I&C) systems, and electrical equipment in mechanical systems were included within the scope of license renewal.

FP. The applicant described the scoping of mechanical systems and structures required for compliance with the FP requirements in LRA Section 2.1.1.3.1, "Commission's Regulations for Fire Protection (10 CFR 50.48)." The applicant examined the CLB and identified mechanical systems and structures relied upon for 10 CFR Part 50, Appendix R and 10 CFR 50.48 requirements. Mechanical systems and structures credited with fire prevention, detection, mitigation in areas with equipment important to safe operation of the plant, and equipment credited with safe shutdown in a fire were included within the scope of license renewal.

EQ. The applicant described the 10 CFR 50.49 EQ requirements in LRA Section 2.1.1.3.2, "Commission's Regulations for Environmental Qualification (10 CFR 50.49)." All plant electrical, I&C systems, and electrical equipment in mechanical systems were included within the scope of license renewal.

Pressurized Thermal Shock. These requirements are not applicable because PNPS is a boiling-water reactor (BWR).

ATWS. The applicant described the scoping of mechanical systems and structures required for compliance with 10 CFR 50.62 ATWS requirements in LRA Section 2.1.1.3.4, "Commission's Regulations for Anticipated Transients without Scram (10 CFR 50.62)." Mechanical systems and structures with 10 CFR 50.62 intended functions were included within the scope of license renewal.

SBO. The applicant described the scoping criteria in LRA Section 2.1.1.3.5, "Commission's Regulations for Station Blackout (10 CFR 50.63)." The SBO diesel generator and the switchyard equipment and related structures required to restore offsite power were included 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 for functions related to the four 10 CFR 54.4(a)(3) regulated areas applicable to BWRs. The staff discussed the methodology with the applicant, reviewed the supporting documentation, and evaluated a sample of the mechanical systems and structures identified as within the scope of license renewal for 10 CFR 54.4(a)(3).

The applicant's LRPGs describe its process for identifying systems and structures within the scope of license renewal. The LRPGs state that all mechanical systems and structures with 10 CFR 54.4(a)(3) intended functions are included within the scope of license renewal and that scoping results are documented in LRPDs. The LRPDs describe the CLB documents used to identify mechanical systems and structures for regulated events. The DBD for each of the regulated events summarizes the design basis and program requirements.

The staff reviewed the LRA sections as well as the LRPGs and LRPDs.

FP. The applicant's LRPDs state that the updated fire hazard analysis, 10 CFR Part 50 Appendix R, safe shutdown analysis, FP plan, and the DBD for the FP and 10 CFR Part 50, Appendix R, programs were used to identify mechanical systems and structures within the scope of license renewal. The report indicates which of the mechanical systems were included within the scope of license renewal because they perform 10 CFR 50.48 intended functions. For example, the RCIC system was credited in the 10 CFR Part 50, Appendix R, safe shutdown analysis for a FP function to extinguish fires in the vital areas of the plant. The LRPDs summarize the scoping results for mechanical systems and identify 18 with one or more 10 CFR 50.48 intended functions. The LRPDs identify the structures included within the scope of license renewal because they perform 10 CFR 50.48 functions. For example, the structures categorized as "trenches, valve pits, manholes, and duct banks" were credited for housing FP equipment. The LRPDs summarize the scoping results for structures and identify 13 with one or more 10 CFR 50.48 intended functions.

EQ. For the EQ regulated event, the staff reviewed the LRPDs and the DBD. The LRPGs for electrical system scoping, screening, and AMRs state that the EQ list, Revision EA, was used not for scoping electrical components for license renewal but during the screening process to identify short-lived components.

ATWS. The applicant's LRPDs identified mechanical systems included within the scope of license renewal because they perform 10 CFR 50.62 intended functions. The LRPDs summarize the scoping results for mechanical systems and note that the control rod drive (CRD) and standby liquid control systems perform 10 CFR 50.62 intended functions. The LRPDs identify one structure included within the scope of license renewal because it performs a 10 CFR 50.62 intended function. The reactor building was included within the scope of license renewal because it houses equipment credited for ATWS.

SBO. The LRPDs state that the SBO diesel generator and the switchyard components required to restore offsite power were included within the scope of license renewal. The LRPDs identify three mechanical systems, all for the SBO diesel generator, included within the scope of license renewal because they perform 10 CFR 50.63 intended functions. The LRPDs note that the transmission and switchyard systems are within the scope of license renewal because they perform 10 CFR 50.63 intended functions. The LRPDs also indicate structures included within the scope of license renewal that perform 10 CFR 50.63 functions, summarize the scoping results for structures, and indicate six structures with one or more 10 CFR 50.63 intended functions.

2.1.4.3.3 Conclusion

The staff concludes that the applicant's methodology for identifying systems and structures meets the scoping criteria of 10 CFR 54.4(a)(3) and is therefore acceptable. This conclusion is based on the sample review, 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. LRA Section 2.1 describes the scoping methodology for safety-related and nonsafety-related systems, structures and equipment relied upon to perform functions for 10 CFR 54.4(a)(3) regulated events. The scoping methodology is consistent with the SRP-LR and NEI 95-10. LRA Section 2.2 evaluates systems and structures for whether they are within the scope of license renewal by the methodology described in LRA Section 2.1. The results of plant level scoping are in LRA Tables 2.2-1a, 2.2-1b, and 2.2-3 for mechanical systems, electrical and I&C systems, and structures, respectively. LRA Tables 2.2-2 and 2.2-4 list systems and structures, respectively, that do not meet 10 CFR 54.4(a) criteria and therefore are excluded from the scope of license renewal.

As noted in the audit report, the applicant documented its methodology for scoping SSCs in accordance with 10 CFR 54.4(a) in the LRPGs and LRPDs. The applicant's approach to system and structure scoping in the site guidance was consistent with the methodology described in LRA Section 2.1. Specifically, the LRPGs specify that personnel performing license renewal scoping use CLB documents, describe the system or structure, and list the functions that the system or structure must accomplish. Sources of information about the CLB for systems include the USAR, DBDs, PNPS Q-list, maintenance rule scoping reports, control drawings, and docketed correspondence. The applicant compared system or structure function lists to the scoping criteria to determine whether the functions met 10 CFR 54.4(a). The applicant documented the plant-level scoping process results in accordance with the LRPGs. These results were in the systems and structures LRPDs, which describe the structure or system, list its functions, and present information about system realignment (as applicable), intended functions, the 10 CFR 54.4(a) scoping criteria met by the system or structure, references, and the basis for the classification of the system or structure intended functions. During the scoping methodology audit, the staff reviewed a sampling of LRPDs and concluded that the applicant's LRPD scoping results document the scoping process in appropriate detail.

On the basis of its review of the LRA, the scoping and screening implementation procedures, and a sampling review of system and structure scoping results during the methodology audit, the staff finds the applicant's scoping methodology for systems and structures adequate. In particular, the staff determines that the applicant's methodology reasonably identified systems and structures within the scope of license renewal and their intended functions.

Component Level Scoping. After identifying the systems and structures within the scope of license renewal, the applicant considered mechanical systems and structures to determine the components in each in-scope system and structure. The structural and mechanical components supporting intended functions and within the scope of license renewal were screened to determine whether they required an AMR. All electrical components of in-scope mechanical and electrical systems were included within the scope of license renewal as commodity groups. The applicant considered three component classifications during this stage of the scoping methodology: mechanical, structural, and electrical. The q-list and controlled plant drawings list plant components comprehensively with type and unique identification numbers for each component within the scope of license renewal and subject to an AMR.

Commodity Groups Scoping. Initially all electrical components within in-scope mechanical and electrical systems were included within the scope of license renewal as commodity groups. Many electrical component types were considered active, in accordance with NEI 95-10, and the SRP-LR. These were screened out as not meeting the passive criteria and were not subject to an AMR. LRA Section 2.1.2.3 describes the commodity groups for evaluation of all in-scope electrical components subject to an AMR.

Structural components were grouped as structural commodity types based on materials of construction. LRA Section 2.1.2.2.1 identifies the various structural commodity groups including:

- steel
- threaded fasteners
- concrete
- fire barriers
- elastomers
- earthen structures
- fluoropolymers and lubrite® sliding surfaces

Insulation. LRA Section 2.4.6, "Bulk Commodities," states that insulation may have the specific intended functions of (1) controlling the heat load during DBAs in areas with safety-related equipment or (2) maintaining integrity so falling insulation (e.g., reflective metallic-type reactor vessel insulation) does not damage safety-related equipment. As such, insulation is included within the scope of license renewal as a commodity group where it provides either or both intended functions.

Consumables. LRA Section 2.1.2.4, "Consumables," addresses consumables and uses SRP-LR Table 2.1-3 to categorize and evaluate them. Consumables were divided into the following four categories for license renewal purposes: (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.

Category (a) consumables are not relied upon to form a pressure-retaining function so are not subject to an AMR. Category (b) consumables are structural sealants for structures within the scope of license renewal that require an AMR. Category (c) consumables are periodically replaced according to plant procedures and, therefore, not subject to an AMR. Category (d) consumables are subject to replacement based on National Fire Protection Association (NFPA) standards according to plant procedures and, therefore, not subject to an AMR.

2.1.4.4.2 Staff Evaluation

The staff reviewed the applicant's methodology for the scoping of plant systems and components for consistency with 10 CFR 54.4(a). The methodology for determining the mechanical systems and components within the scope of license renewal is documented in LRPDs, and plant-level scoping results are shown in LRA Table 2.2-1. The scoping process defined the entire plant in terms of systems and structures. Specifically, the LRPGs identify systems and structures subject to 10 CFR 54.4 review, describe the processes for recording the results of the review, and indicate whether the system or structure performs intended functions consistent with 10 CFR 54.4(a) criteria. The process was completed for all systems and structures to address the entire plant. The applicant's personnel initially evaluated systems and structures in the CLB.

The staff noted that a system or structure is presumed to be within the scope of license renewal if it performs one or more safety-related functions or meets the other scoping criteria per the Rule as determined by CLB review. Mechanical and structural component types supporting intended functions were considered to be within the scope of license renewal. All component types in electrical systems within the scope of license renewal were also considered to be within the scope of license renewal and placed in commodity groups. The electrical commodity groups were screened further for whether they required an AMR. The staff found no discrepancies in the applicant's methodology.

The staff reviewed the applicant's methodology for generating commodity groups. Separate commodity groups for various mechanical, structural, and electrical components were identified in the LRPDs. The staff reviewed the commodity group level functions evaluated by the applicant in accordance with 10 CFR 54.4(a). This process determined whether the commodity group is within the scope of license renewal. The staff finds the methodology acceptable.

The staff reviewed the scoping process results documented in the LRPDs in accordance with the LRPGs. This documentation describes the system or structure and indicates the 10 CFR 54.4(a) scoping criteria met. The staff also reviewed a sample of the applicant's scoping documentation and concluded that it documents the scoping process in appropriate detail.

The staff reviewed the applicant's evaluation of plant insulation as documented in the LRPD and the bulk commodities AMR. The applicant considered insulation within the scope of license renewal and subject to an AMR because of its intended functions of heat transfer reduction and structural or functional support to nonsafety-related structures and components the failure of which could affect safety-related functions. Both mirror and non-mirror insulation were evaluated. The staff concludes that the applicant's methods and conclusions for insulation are acceptable.

The staff reviewed the scoping and screening of consumables and finds that the applicant followed the process described in SRP-LR and appropriately categorized the various consumables. Plant consumables initially were evaluated for whether any required an AMR (*e.g.*, structural sealants). Additionally, the applicant cited all pertinent industry guidelines (*e.g.*, NFPA standards) for replacement of the item.

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 scoping methodology for plant SSCs, commodity groups, insulation, and consumables is acceptable. In particular, the staff determines that the applicant's methodology reasonably identifies systems, structures, component types, and commodity groups within the scope of license renewal and their intended functions.

2.1.4.5 Mechanical Component Scoping

2.1.4.5.1 Summary of Technical Information in the Application

LRA Section 2.1.2.1.3, "Mechanical System Drawings," addresses how the LRBDs are prepared to indicate system portions that support system intended functions within the scope of license renewal. Boundary flags are marked with safety-to-nonsafety class breaks to indicate the system intended function boundaries for system in-scope portions. Components within these boundary flags and class breaks support system intended functions within the scope of license renewal. Components subject to an AMR (*i.e.*, passive, long-lived components supporting the system intended functions) are highlighted by color coding to indicate which system AMRs evaluated them. Drawings with only highlighting and no boundary flags indicate that all components shown support the system intended functions unless excluded by safety-to-nonsafety class breaks.

The applicant's determination of whether a component meets 10 CFR 54.4(a)(2) scoping criteria is based on structural/seismic boundaries or the component location in the building, whether it contains gas or liquid, and its proximity to safety-related equipment. Additionally, the applicant states that at PNPS, a conservative approach to spacing, in accordance with 10 CFR 54.4(a)(2), resulted in almost all mechanical systems depicted in LRA Table 2.3.3.14-A being within the scope of license renewal. Every component in these mechanical systems, with the except those listed in LRA Table 2.3.3.14-B, is subject to an AMR.

2.1.4.5.2 Staff Evaluation

The staff evaluated LRA Sections 2.1.1, 2.1.2.1, and 2.1.2.1.3 and the LRPDs, LRPGs, and aging management reports to complete the review of mechanical scoping process. The program guidelines and aging management reports provided instructions for the evaluation of individual mechanical system components by the scoping criteria. The CLB documents were utilized for the determination of whether a system or component is within the scope of 10 CFR 54.4(a). Examples of these sources included, but were not limited to, the UFSAR, maintenance rule basis documents, separate ATWS, EQ, FP, and SBO documents, technical specifications, and safety evaluation reports (SERs). Additional sources of mechanical component information included the q-list and individual system flow diagrams.

The applicant used mechanical system diagrams to create for each system license renewal boundaries showing the in-scope components. Components that support a safety-related function or a regulated event were evaluated further during the screening process to determine whether they should be subject to an AMR. Nonsafety-related components connected to safety-related components and structurally supporting the safety-nonsafety interface, or components the failure of which could prevent satisfactory accomplishment of safety-related functions by spatial interaction with safety-related SSCs, are included within the scope of license renewal and in the AMR for the 10 CFR 54.4(a)(2) evaluation, but are not specifically highlighted on the license renewal drawings. As part of the applicant's verification process, the list of mechanical components within the scope of license renewal was compared to the data in the q-list and the PNPS system flow diagrams to confirm the scope of system components.

The staff reviewed the implementation guidance and the CLB documents for mechanical system scoping and found the guidance and CLB source information to be acceptable. They indicated mechanical components and mechanical system support structures to be within the scope of license renewal. The staff conducted detailed discussions with the applicant's license renewal project management personnel and reviewed documentation of 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 procedures of the applicant's methodology were consistent with the description in LRA Section 2.1 and the guidance of SRP-LR Section 2.1 and were adequately implemented.

Scoping Methodology for the RCIC System. LRA Section 2.3.2.5, "Reactor Core Isolation Cooling," states the scoping and screening methodology results for RCIC system SSCs. The RCIC is a safety-related system which provides makeup water to the reactor vessel during shutdown and isolation to supplement or replace the normal makeup sources. The results of the RCIC scoping effort and AMR are documented in the applicant's LRPDs and AMRM reports. The RCIC system accomplishes the following scoping criteria of the Rule.

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

- Provide makeup water to the reactor vessel for adequate core cooling in reactor isolation
- Support primary containment isolation
- Maintain reactor coolant system pressure boundary integrity

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

- Maintain integrity of nonsafety-related components so no physical interaction with safety-related components prevents satisfactory accomplishment of a safety function

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

- RCIC is credited in the 10 CFR Part 50, Appendix R, safe shutdown analysis for FP (10 CFR 50.48)

The RCIC license renewal scoping boundary includes portions of nonsafety-related piping and equipment extending beyond the safety-related/nonsafety-related interface. The scoping results indicated that the RCIC system has five functions within the scope of license renewal.

As part of the audit, the staff reviewed the applicant's methodology for identifying RCIC mechanical component types 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 had identified and used pertinent engineering and licensing information to determine the RCIC mechanical component types within the scope of license renewal. As part of the review process, the staff evaluated each intended function for the RCIC system, the basis for inclusion of the intended function, and the process for identifying each of the system components credited with performing the intended function. The staff verified that the applicant had highlighted system P&IDs to develop the system boundaries in accordance with the procedural guidance. During the audit, the staff also engaged in detailed discussions with the applicant's license renewal personnel to assess whether the applicant appropriately implemented the license renewal scoping methodology and procedures and whether the scoping results were consistent with 10 CFR 54. The applicant knew about the process and conventions for establishing boundaries as defined in the license renewal implementation procedures. Additionally, the staff ascertained that the applicant had independently verified the results in accordance with the governing procedures. Specifically, other license renewal personnel knowledgeable about the system had examined the marked-up drawings independently for accurate identification of system intended functions. The applicant added cross-discipline verification and independent examinations of the highlighted drawings before final approval of the scoping effort. The staff determined that the applicant's methodology was consistent with the description of LRA Section 2.1 and the guidance in SRP-LR Section 2.1 and was adequately implemented.

2.1.4.5.3 Conclusion

Based on its review of the LRA, scoping implementation procedures, and the system sample and discussions with the applicant, the staff concludes that the applicant's methodology for identifying mechanical systems for 10 CFR 54.4(a) scoping criteria is acceptable.

2.1.4.6 Structural Component Scoping

2.1.4.6.1 Summary of Technical Information in the Application

LRA Section 2.1 describes the methodology for identifying structures within the scope of license renewal. Initially all plant structures were identified. Structures with 10 CFR 54.4(a) intended functions were included within the scope of license renewal and listed in LRA Table 2.2-3. Structures not within the scope of license renewal are listed in LRA Table 2.2-4. Structures were included within the scope of license renewal because they house or protect safety-related equipment or provide flood barriers, missile shields, or structural support. Structures that house or protect nonsafety-related equipment for SBO and FP also were included within the scope of license renewal. LRA Section 2.4 describes the scoping results for the individual structures within the scope of license renewal. For example, LRA Section 2.4.5 describes the intended functions for yard structures, including tank foundations, the security diesel generator building, the SBO diesel generator building, transformer foundations, switchyard relay house and switchyard structural components, trenches, valve pits, manholes and duct banks, breakwaters, jetties, revetments, and the discharge structure.

2.1.4.6.2 Staff Evaluation

The staff reviewed the applicant's approach for identifying structures relied upon to perform 10 CFR 54.4(a) functions. As part of this review, the staff discussed the methodology with the applicant, reviewed the documentation supporting the review, and evaluated the scoping results for several structures within the scope of license renewal.

The applicant's LRPGs describe the applicant's process for identifying structures within the scope of license renewal. The LRPGs state that all structures that perform intended functions are included within the scope of license renewal and that the scoping results are documented in the LRPDs, which list all structures evaluated. The applicant used UFSAR, maintenance rule SSC basis documents, master structures list, q-list, and plant drawings to identify structures.

The staff reviewed the LRA sections noted, the LRPDs, plant drawings, the q-list, and the master structures list. Structural scoping considered all plant and yard structures. The LRPDs identify the intended functions for each structure required for compliance with 10 CFR 54.4(a) criteria. The structural component intended functions were based on NEI 95-10 and the SRP-LR. For structures, the evaluation boundaries were determined by a complete description of each structure according to its intended functions. The results of the review were documented in the LRPDs, which listed structures, evaluation results for each of the 10 CFR 54.4(a) criteria for each structure, a description of structural intended functions, and source reference information for the functions.

The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation of the scoping process. The staff assessed whether the scoping methodology outlined in the LRA and procedures had been implemented appropriately and whether the scoping results were consistent with CLB requirements. In these audit activities, the staff found no discrepancies between the methodology documented and the implementation results.

2.1.4.6.3 Conclusion

Based on its review of the LRA, the applicant's detailed scoping implementation procedures, and a sampling of structural scoping results, the staff concludes that the applicant's methodology for identification of structural component types within the scope of license renewal meets 10 CFR 54.4(a) requirements and, therefore, is acceptable.

2.1.4.7 Electrical Component Scoping

2.1.4.7.1 Summary of Technical Information in the Application

LRA Section 2.1.1, "Scoping Methodology," describes the scoping process for electrical systems and components. For the purposes of system level scoping, plant electrical and I&C systems were included within the scope of license renewal. Electrical and I&C components in mechanical systems were included in the evaluation of electrical systems. LRA Section 2.1.1 refers to LRA Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Control Systems," which further states that the default inclusion of plant electrical and I&C systems within the scope of license renewal reflects the method used for the scoping of electrical systems, which is different from the methods used for mechanical systems and structures. The approach for electrical and I&C components included components in the review unless specifically screened out. When used with the plant spaces approach, this approach eliminated the need for unique identification of every component and its specific location and gave assurance that no component was excluded from an AMR.

2.1.4.7.2 Staff Evaluation

As documented in the audit report, the staff evaluated LRA Sections 2.1.1 and 2.5 and the applicant's implementing procedures and aging management reports governing the electrical scoping methodology. The scoping phase for electrical components began with the placement of all electrical components from plant systems within the scope of license renewal. In addition, any electrical components from non-plant systems that met the 10 CFR 54.4(a) criteria for inclusion (*e.g.*, components credited for SBO) also were included within the scope of license renewal. The staff reviewed the LRPDs and AMRE and data sources for the electrical scoping information. The staff selected several examples of components to verify the applicant's adequate evaluation of AMRE components in accordance with the LRPGs.

2.1.4.7.3 Conclusion

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

2.1.4.8 Conclusion for Scoping Methodology

Based on its review of the LRA and the scoping implementation procedures, the staff determines that the applicant's scoping methodology is consistent with SRP-LR guidance and has identified SSCs within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(1), (a)(2), and (a)(3). Therefore, the staff concludes that the applicant's methodology meets 10 CFR 54.4(a) requirements.

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

LRA Section 2.1.2, "Screening Methodology," addresses the method for identifying components from in-scope systems and structures subject to an AMR. The screening process consisted of the following steps:

- Identification of long-lived or passive components for each in-scope mechanical system, structure, and electrical commodity group
- Identification of the intended function(s) for all mechanical and structural component types and electrical commodity groups

Active components were screened out and therefore, required no AMRs. The screening process also identified short-lived components and consumables. The short-lived components are not subject to an AMR. Consumables are a special class of items that include packing, gaskets, component seals, O-rings, oil, grease, component filters, system filters, fire extinguishers, fire hoses, and air packs. Structural sealants for structures were the only consumables within the scope of license renewal requiring an AMR.

2.1.5.1.2 Staff Evaluation

Pursuant to 10 CFR 54.21, the staff requires each LRA to contain an IPA that identifies structures and components within the scope of license renewal subject to an AMR. The IPA must identify components that perform intended functions without moving parts or a change in configuration or properties (passive) and components not subject to periodic replacement based on a qualified life or specified time period (long-lived). The IPA describes and justifies the methodology for determining the passive and long-lived structures and components and demonstrates that the effects of aging on those structures and components will be adequately managed to maintain intended function(s) under all design conditions imposed by the plant-specific CLB for the period of extended operation.

The staff reviewed the applicant's methodology 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 structures and components were subject to an AMR in accordance with 10 CFR 54.21(a)(1). LRA Section 2.1.2 addresses these screening activities for the component types and commodity groups within the scope of license renewal.

The screening process evaluated these in-scope component types and commodity groups to determine which were long-lived and passive and therefore subject to an AMR. The staff reviewed the results in LRA Sections 2.3, 2.4, and 2.5 for component types and commodity groups subject to an AMR. The staff also reviewed the screening results reports for the RCIC system and yard structures.

The applicant discussed in detail the processes for each discipline and provided administrative documentation describing the screening methodology. Specific methodology for mechanical, electrical, and structural is addressed in SER Sections 2.1.5.2 - 2.1.5.4.

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 determines that the applicant's screening methodology is consistent with SRP-LR guidance and capable of identifying passive, long-lived components within the scope of license renewal and subject to an AMR. The staff determines that the applicant's process for identifying component types and commodity groups subject to an AMR meets 10 CFR 54.21 requirements and, therefore, is acceptable.

2.1.5.2 Mechanical Component Screening

2.1.5.2.1 Summary of Technical Information in the Application

LRA Section 2.1.2.1, "Screening of Mechanical Systems," addresses the screening methodology for passive and long-lived mechanical components and their support structures subject to an AMR. License renewal drawings indicated system portions that support system intended functions within the scope of license renewal (with the exception of systems in-scope for 10 CFR 54.4(a)(2) for physical interactions). In addition, the drawings identify components subject to AMRs. Boundary flags in conjunction with safety-to-nonsafety class breaks show system intended function boundaries. Boundary flags are noted on the drawings as system intended function boundaries. All components within these boundary flags and class breaks support system intended functions within the scope of license renewal. Components subject to AMRs (*i.e.*, passive, long-lived components that support system intended functions) are highlighted to indicate that the component is subject to an AMR.

2.1.5.2.2 Staff Evaluation

As documented in the audit report, the staff evaluated the mechanical screening methodology described in LRA Section 2.1.2.1, the LRPDs, the LRPGs, and the aging management reports. The mechanical system screening process began with the scoping process results. The applicant reviewed each mechanical system flow diagram for passive and long-lived components. To identify system components required to perform a system intended function, the applicant initially listed mechanical system components based on information derived from controlled system diagrams and the q-list. The LRPGs and LRPDs address in detail how to: (1) determine system boundaries; (2) indicate within a specific flow path components required for performance of intended functions; and (3) determine and identify system and interdisciplinary interfaces (*e.g.*, mechanical/structural, mechanical/electrical, structural/electrical). Where the mechanical system flow diagrams did not provide sufficient detail, as for large vendor-supplied components (*e.g.*, compressors, emergency diesel generators), the applicant studied component drawings or vendor manuals as necessary for individual components.

The staff reviewed the results of the boundary evaluation and discussed the process further with the applicant. The staff verified that mechanical system evaluation boundaries were established for each system within the scope of license renewal. These boundaries were determined by mapping the pressure boundary for system-level license renewal intended functions onto the controlled system drawings. Mechanical component types were reviewed for whether all component types had been identified. Any component type not already identified was created for use in the evaluation. A preparer and an independent reviewer comprehensively evaluated the boundary drawings for completeness and accuracy of the results. As part of the evaluation, the applicant also benchmarked system passive and long-lived components against previous LRAs for similar systems.

In the audit, the staff reviewed the applicant's methodology for SSCs meeting the screening criteria of the Rule. The staff verified that the applicant had implemented and followed the guidance in the staff's SRP-LR and industry standard NEI 95-10 in the screening. The staff confirmed that the applicant had developed sufficiently detailed procedures for the screening of mechanical systems, implemented those procedures, and adequately documented the results in the aging management reports.

Additionally, the staff reviewed the screening activities for the RCIC system. The staff reviewed the system intended functions and source documents for the system, the RCIC flow diagrams, and the results documented in the aging management report. The staff found no discrepancies with the evaluation and determined that the applicant had adequately followed the process documented in the LRPDs and adequately documented the results in the aging management reports.

2.1.5.2.3 Conclusion

Based on its review of the LRA, the screening implementation procedures, and a sample of RCIC system screening results, the staff determines 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 meets 10 CFR 54.21(a)(1) requirements.

2.1.5.3 Structural Component Screening

2.1.5.3.1 Summary of Technical Information in the Application

LRA Sections 2.1.2.2 and 2.4 describe the methodology for structural screening. LRA Section 2.1.2.2 states that structural components were determined for each structure within the scope of license renewal. Specific structural components were identified from review of the CLB (drawings, etc.). LRA Section 2.4 summarizes the screening results for structures. Passive and long-lived structural components performing intended functions were identified as subject to an AMR. SRP-LR and NEI 95-10, Appendix B, were the bases for identification of passive structural components. Structural components (*e.g.*, door, gate, pipe support, strut, or siding) were categorized as steel, threaded fasteners, concrete, fire barriers, elastomers, earthen structures, or Fluoropolymers and Lubrite® sliding surfaces. Structural components common to all structures, like piping supports, were categorized as bulk commodities. LRA Section 2.4.6 summarizes the screening results for structural bulk commodities.

2.1.5.3.2 Staff Evaluation

The staff reviewed the applicant's methodology for identifying structural components subject to an AMR in accordance with10 CFR 54.21(a)(1). In this review, the staff discussed the methodology with the applicant, reviewed the documentation supporting the activity, and evaluated the screening results for several structures within the scope of license renewal.

The applicant's LRPGs describe the applicant's process for screening structural components subject to an AMR. The LRPGs stated that all structural components that perform intended functions and are passive and long-lived are subject to an AMR. The screening results were described in a separate report. For example, the AMRCs documented the screening review of the components for yard structures.

The staff reviewed the applicant's methodology for structural screening described in LRA sections noted and in the LRPGs and AMRCs. The applicant's screening review in accordance with the LRPGs captured pertinent structure design information, component, materials, environments, and aging effects. The staff verified that the applicant had used the lists of passive structures and components embodied in the regulatory guidance as initial starting points and had supplemented them with additional items unique to the site or for which there was no direct match to the generic lists (*i.e.*, material-environment combinations). As one of the general rules for structural screening, the applicant assessed components which support or interface with electrical components (*e.g.*, cable trays, conduits, instrument racks, panels and enclosures) as structural.

The boundary for a structure was the entire building including base slabs, foundations, walls, beams, slabs, and steel superstructure. The AMRCs identified each individual structure and component and indicated whether the component is subject to an AMR. Each component was classified as a component type or as a material. The applicant discussed with the staff in detail the screening methodology as well as the screening results for a selected group of structures.

The staff also examined the applicant's results from the implementation of this methodology by reviewing several of the plant structures within the scope of license renewal. The staff reviewed the AMRCs to verify whether the applicant had evaluated relevant structural components comprehensively. The review included in-scope components, the corresponding component-level intended functions, and the list of components subject to AMRs. The staff also discussed the process and results with the applicant and found no discrepancies between the methodology documented and the implementation results.

2.1.5.3.3 Conclusion

Based on its review of the LRA, the applicant's detailed screening implementation procedures, and a sampling of structural screening results, the staff concludes that the applicant's methodology for identification of passive, long-lived structural component types within the scope of license renewal and subject to an AMR meets 10 CFR 54.21(a)(1) requirements.

2.1.5.4 Electrical Component Screening

2.1.5.4.1 Summary of Technical Information in the Application

LRA Section 2.1.2.3, "Screening of Electrical and Instrumentation and Control Systems," addresses the use of NEI 95-10, Appendix B, for electrical commodities considered passive. The electrical commodity groups were cross-referenced to the appropriate NEI 95-10 commodity, which indicates the passive commodity groups.

The applicant determined that the majority of electrical and I&C commodity groups are active and require no AMR. Two passive electrical and I&C commodity groups met the 10 CFR 54.21(a)(1)(i) criterion (components that perform intended functions without moving parts or without change in configuration or properties):

- high-voltage insulators
- cables and connections, buses, electrical portions of electrical and I&C penetration assemblies

Additionally, the pressure boundary function of some electrical and I&C components specified in NEI 95-10, Appendix B, (flow elements, vibration probes) was considered in the AMRMs when applicable. Electrical components supported by structural commodities (cable trays, conduit and cable trenches) were included in the AMRCs.

The applicant reviewed the passive electrical components for those replaced based on a qualified life and therefore not subject to an AMR. The applicant determined that the components included in the EQ of Electric Components Program per 10 CFR 50.49 (EQ) are replaced based on qualified life and, therefore, are not subject to AMRs. The applicant determined that the AMRs would be for the passive, non-EQ electrical and I&C components.

2.1.5.4.2 Staff Evaluation

The staff reviewed in LRA Section 2.1.2.3 the applicant's methodology for electrical screening and the applicant's implementation procedures and aging management reports. The applicant used the screening process described in these documents to identify the electrical commodity groups subject to an AMR. The applicant used the EQ information, the single-line drawings, and cable procurement specifications as data sources for the electrical and I&C components, including fuse-holders. The applicant determined that there were no fuse-holders located outside of active devices and subject to an AMR.

The applicant assembled a table of seven commodities determined to meet the passive criteria and further grouped them in accordance with NEI 95-10 as (1) cables and connections, electrical portions of penetration assemblies, switchyard bus, transmission bus, transmission conductors, and uninsulated ground conductors and (2) high-voltage insulators. The applicant evaluated the passive commodities for whether they were subject to replacement based on a qualified life or specified time period (short-lived) or not (long-lived). The applicant used the EQ master list for components included in the EQ program and subject to replacement based on a qualified life (short-lived) and therefore not subject to an AMR. The remaining passive, long-lived components were determined to be subject to an AMR.

The staff determined that the applicant's screening was a two-stage process. The applicant initially had developed a table of components which passively performed safety functions and collected in a "passive component" table the long-lived components by considering the population of the "passive component" table and assembling a "long-lived component" table. The staff reviewed the information in the scoping file and "passive component" table to verify that the applicant had appropriately included the passive electrical components into the "passive component" table. In addition, the staff reviewed the "long-lived component" table of components long-lived and not subject to periodic replacement and therefore to an AMR. The staff reviewed the screening of selected components for correct implementation of the LRPGs and aging management reports.

2.1.5.4.3 Conclusion

The staff reviewed the LRA, procedures, electrical drawings, and a sample of the results of the screening methodology. The staff determined that the applicant's methodology was consistent with the LRA description and the applicant's implementing procedures. Based on its review of LRA information, 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 subject to an AMR is consistent with 10 CFR 54.21(a)(1) and, therefore, acceptable.

2.1.5.5 Conclusion for Screening Methodology

Based on its review of the LRA and 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 is consistent with the guidance of the SRP-LR and has identified passive, long-lived components within the scope of license renewal and 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, acceptable.

2.1.6 Summary of Evaluation Findings

The information 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 August 22, 2006, formed the basis of the staff's determination that the applicant's scoping and screening methodology was consistent with the requirements of the Rule. Based on this determination, the staff concludes that the applicant's methodology for identifying SSCs within the scope of license renewal and structures and components requiring an AMR is consistent with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1), and, therefore, acceptable.

2.2 Plant-Level Scoping Results

2.2.1 Introduction

In LRA Section 2.1, the applicant described the methodology for identifying structures, systems, and components (SSCs) within the scope of license renewal. In LRA Section 2.2, the applicant used the scoping methodology to determine which SSCs must be included within the scope of license renewal. The staff reviewed the plant-level scoping results to determine whether the applicant has properly identified all systems and structures relied upon to mitigate design basis events (DBEs), as required by 10 CFR 54.4(a)(1), systems and structures the failure of which could prevent satisfactory accomplishment of any safety-related functions, as required by 10 CFR 54.4(a)(2), and systems and structures relied on in safety analyses or plant evaluations to perform functions required by regulations referenced in 10 CFR 54.4(a)(3).

2.2.2 Summary of Technical Information in the Application

LRA Tables 2.2-1a, 2.2-1b, and 2.2-3 list plant mechanical systems, electrical and I&C systems, and structures within the scope of license renewal and LRA Tables 2.2-2 and 2.2-4 list mechanical systems and structures not within the scope of license renewal. Based on the DBEs considered in the plant's CLB, other CLB information relating to nonsafety-related systems and structures, and certain regulated events, the applicant identified plant-level systems and structures within the scope of license renewal as defined by 10 CFR 54.4.

2.2.3 Staff Evaluation

In LRA Section 2.1, the applicant described its methodology for identifying systems and structures within the scope of license renewal and subject to an AMR. The staff reviewed the scoping and screening methodology and provides its evaluation in SER Section 2.1. To verify that the applicant properly implemented its methodology, the staff's review focused on the implementation results shown in LRA Tables 2.2-1a, 2.2-1b, 2.2-2, 2.2-3, and 2.2-4, and RAIs 2.2-1 and 2.2-2 to confirm that there were no omissions of plant-level systems and structures within the scope of license renewal.

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

The staff sampled the UFSAR contents based on the systems and structures in the LRA Section 2.2 tables for systems or structures with intended functions within the scope of license renewal, as defined by 10 CFR 54.4 were omitted from the scope of license renewal. The staff's review of LRA Section 2.2 found areas in which additional information was necessary to complete the review of the applicant's plant-level scoping results. Therefore, the staff issued RAIs on the specific issues to determine whether the applicant had properly identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.2-1 dated July 31, 2006, the staff stated that it was not clear whether all mechanical systems described in the UFSAR were included in the mechanical system names in LRA Tables 2.2-1a and 2.2-2. To facilitate the plant-level scoping review, the staff requested from the applicant a complete cross-reference list of mechanical system names against system numbers and the specific source for this reference.

In its response dated August 30, 2006, the applicant stated that all mechanical systems described in the UFSAR are included in the mechanical system names in LRA Tables 2.2-1a and 2.2-2. In LRA Sections 2.1.1 and 2.2, the applicant stated that the list of systems in these tables and determination of system boundaries are based on maintenance rule scoping documents, the q-list, plant drawings, the UFSAR, and system design basis documents.

The applicant restated the scoping methodology in LRA Section 2.1.1 as follows:

> The list of systems used for scoping began with a list developed from maintenance rule scoping documents. This list was adjusted based on reviews of plant drawings, the Q-list, the PNPS Updated Final Safety Analysis Report (UFSAR), and other station documents reviewed during scoping.
>
> For mechanical system scoping, system boundaries were determined based on maintenance rule scoping documents, the Q-list, plant drawings, and system design basis documents. Although system number codes are used at PNPS in some component identification numbers, the system number in the component identification does not always correspond to the actual system that contains the component. Therefore, PNPS system boundaries are not defined based solely on the system number assigned to components and a system may include components using more than one system code number. This is consistent with the approach used for defining system boundaries in PNPS documents, such as maintenance rule scoping documents and the Q-list.
>
> Some system numbers have been used for multiple related systems (*e.g.*, the reactor building and turbine building closed cooling water systems both use the number 30 on piping and instrument drawings (P&IDs)). To simplify administrative control of these systems, their numbers include a letter suffix (*e.g.*, the reactor building and turbine building closed cooling water systems are 30A and 30B, respectively). Although the letter suffix is not included as part of the component identification code, the number and letter combination is used in other system-level plant documentation, such as the Q-list. Such systems may be evaluated as a group (*e.g.*, HVAC systems 24A-R) or separately (*e.g.*, system 30A and 30B), based on system function.

The applicant further stated that "system numbers" in LRA Tables 2.2-1a and 2.2-2 are historical designations not always aligned with current usage of system names. LRA system evaluation boundaries are based mainly on the P&IDs and on system functions supported by the components. These system numbers in some component identification numbers are useful in reading the P&IDs, the reason why the numbers for components in the LRA-identified system are in Tables 2.2-1a and 2.2-2.

A cross-reference list of mechanical system names against system numbers would not be useful in determining whether all mechanical systems described in the UFSAR are included in the mechanical system names in LRA Tables 2.2-1a and 2.2-2 because the names assigned to these "system numbers" do not correspond with UFSAR system names.

The applicant also provided, in its response, a cross-reference matrix of UFSAR system names by UFSAR Section versus the LRA system names in LRA Tables 2.2-1a, 2.2-1b, and 2.2-2.

Based on its review, the staff finds the applicant's response to RAI 2.2-1 acceptable because it provided sufficient details to verify that mechanical systems described in the UFSAR are within the scope of license renewal. Therefore, the staff's concern described in RAI 2.2-1 is resolved.

In RAI 2.2-2 dated July 31, 2006, the staff noted in UFSAR Section 10.22.7.4 that the electrolytic hydrogen water chemistry system credits condenser bay and turbine building forced ventilation with prevention of the accumulation of combustible mixtures of hydrogen and oxygen from small hydrogen leaks. In LRA Table 2.2-2, the applicant stated that this system is excluded from the scope of license renewal. The staff questioned the exclusion because the applicant appeared to credit the turbine building heating, ventilation, and air conditioning (HVAC) system with prevention of an explosive mixture in the condenser bay and turbine buildings. The staff requested justification for the exclusion from the scope of license renewal or inclusion because of a potential 10 CFR 54.4(a)(2) explosive effect on proximate safety-related SSCs.

In its response dated August 30, 2006, the applicant stated that UFSAR Section 10.22 describes the electrolytic hydrogen water chemistry system as abandoned and to be removed and that the UFSAR had not been updated to reflect the removal. The system, however, was designed so a postulated failure would not affect the operation of any safety-related systems. System piping and components were placed sufficiently distant from any safety-related equipment such that a perturbation from a leak that could potentially lead to a detonation or fire would have no adverse effect on any safety-related equipment. As this system cannot affect any safety-related equipment through adverse interaction including spatial (leakage) or structural, it has no 10 CFR 54.4(a)(2) functions and is not within the scope of license renewal. The applicant explained that this approach is conservative because 10 CFR 54.4(a)(2) involves interaction causing loss of function; not simply damage to safety-related equipment.

Based on its review, the staff finds the applicant's response acceptable because it adequately explained that the electrolytic hydrogen water chemistry system has been abandoned, will be removed and cannot affect any safety-related equipment through explosive interaction. The staff's concern described in RAI 2.2-2 is resolved.

2.2.4 Conclusion

The staff reviewed LRA Section 2.2, the RAI responses, and the UFSAR supporting information to determine whether the applicant failed to identify any systems and structures within the scope of license renewal. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified in accordance with 10 CFR 54.4 the systems and structures within the scope of license renewal.

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:

- reactor coolant system
- engineered safety features
- auxiliary systems
- steam and power conversion systems

Under 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.

Staff Evaluation Methodology. The staff's evaluation of the information in the LRA was the same for all mechanical systems. 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 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).

Scoping. In its scoping evaluation, the staff reviewed the applicable LRA sections and component drawings, focusing on components that have not been identified as within the scope of license renewal. The staff reviewed relevant licensing basis documents, including the UFSAR, for each mechanical system to determine whether the applicant has omitted from the scope of license renewal components with intended functions delineated under 10 CFR 54.4(a). The staff also reviewed the licensing basis documents to determine whether the LRA specified all intended functions delineated under 10 CFR 54.4(a). The staff requested additional information to resolve any omissions or discrepancies identified.

Screening. After its review of the scoping results, the staff evaluated the applicant's screening results. For those SCs with intended functions, the staff sought to determine whether (1) the functions are performed with moving parts or a change in configuration or properties or (2) the SCs are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff sought to confirm that these SCs were subject to an AMR, as required by 10 CFR 54.21(a)(1). The staff requested additional information to resolve any omissions or discrepancies identified.

Two-Tier Scoping Review Process for Balance of Plant (BOP) Systems. There are 28 mechanical systems in the LRA among which 16 are BOP, including most of the auxiliary and all the steam and power conversion systems. The staff's scoping review for the 16 BOP systems was two-tier.

The staff reviewed the LRA and UFSAR descriptions focusing on system intended functions to screen all the BOP systems into two groups based on the following criteria:

- safety importance/risk significance
- potential for system failure to cause failure of redundant safety system trains
- operating experience indicating likely passive failures
- systems subject to omissions found in previous LRA reviews

Safety importance/risk significance examples based on the results of the individual plant examination are the reactor building closed cooling water (RBCCW) system, the emergency diesel generator (EDG) and support systems, and the SSW system. An example of a system the failure of which could cause failure of redundant trains is a drain system for flood protection. Examples of systems with operating experience indicating likely passive failures include the main steam, feedwater, and SSW systems. Examples of systems with omissions found in previous LRA reviews include the fuel pool cooling and fuel handling and storage system and makeup water sources to safety systems.

Primarily because of the small number of BOP systems, the staff selected all in its scope for a detailed (Tier 2) scoping review with no Tier 1 review of any BOP license renewal systems in the LRA. However, the staff noted that of a total of 35 auxiliary systems, grouped as miscellaneous systems in LRA Section 2.3.3.14, within the scope of license renewal in accordance with 10 CFR 54.4(a)(2), 21 of the 35 already were described in other LRA sections. Tier 2 requires review of detailed boundary drawings in accordance with SRP-LR Section 2.3; however, 14 of the 35 systems within the scope of license renewal by 10 CFR 54.4(a)(2) criteria include neither detailed boundary drawings nor systems descriptions. The following list is of these 14 systems:

- circulating water
- condensate
- condensate demineralizers
- extraction steam
- feedwater
- feedwater heater drains and vents
- offgas and augmented offgas
- potable and sanitary water
- radioactive waste
- reactor water cleanup
- sampling
- sanitary soiled waste and vent, plumbing and drains
- screen wash
- turbine building closed cooling water

The staff examined the applicant's environmental report, Appendix E, Attachment E.1, "Evaluation of Probabilistic Safety Analysis Model," to verify that there is no risk significance system in the list. None of the 14 systems is a dominant contributor to the risk reduction worth rankings to core damage frequency nor are these systems involved in the dominant initiating events.

2.3.1 Reactor Coolant System

LRA Section 2.3.1 states that the purposes of the reactor coolant system (RCS) are to house the reactor core and to transport fluids to or from it. The RCS includes the reactor vessel, reactor vessel internals, reactor recirculation system (RCS), and CRD system.

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

- 2.3.1.1 reactor vessel
- 2.3.1.2 reactor vessel internals
- 2.3.1.3 reactor coolant pressure boundary

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. The staff's review of the reactor vessel, reactor vessel internals, RCS, and CRD system proceeded as follows.

Summary of Technical Information in the Application. LRA Section 2.3.1 describes the RCS, including the reactor vessel, reactor vessel internals, RCS, and CRD system. Summaries of each follow.

Reactor Vessel, Internals, and Reactor Recirculation System. The reactor vessel, a primary pressure vessel with a bolted head, is comprised of a shell, a removable top head, an integrally-welded bottom head, flanges and bolting, multiple nozzles and safe-ends, CRD penetrations, instrument penetrations, head-to-flange bolting, and a support skirt. Additional detail on the reactor vessel is in LRA Section 2.3.1.1. The reactor vessel internals distribute the flow of coolant delivered to the vessel, locate and support the fuel assemblies, and contain the core within an inner volume that can be flooded following a break in the nuclear system process barrier outside the reactor vessel. Additional detail on the reactor vessel internals is in LRA Section 2.3.1.2. The RCS supplies the reactor core with a variable forced circulation of subcooled water to vary reactor power and maintain normal operating temperature.

The reactor vessel, internals, and RCS have safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the reactor vessel, internals, and RCS could prevent satisfactory performance of a safety-related function. In addition, the reactor vessel, internals, and RCS perform FP functions.

CRD System. The CRD system controls core reactivity by positioning control rods during power operation by individual CRD mechanisms. The CRD system adjusts core reactivity (for power level control and power shaping) by incremental positioning of individual rods in the core. When transient or accident conditions require rapid shutdown of the reactor (scram), the CRD system inserts all rods into the core quickly enough to avoid fuel damage.

The CRD system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the CRD system could prevent satisfactory performance of a safety-related function. In addition, the CRD system performs FP and ATWS functions.

LRA Table 2.3.3-14-6 shows CRD system nonsafety-related component types affecting safety-related systems, within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- orifice
- piping
- pump casing
- strainer housing
- tubing
- valve body

The CRD system component intended function within the scope of license renewal is to provide a pressure boundary.

LRA Table 2.3.3-14-26 shows RCS nonsafety-related component types affecting safety-related systems, within the scope of license renewal, and subject to an AMR:

- bolting
- piping
- tubing
- valve body

The RCS component intended function within the scope of license renewal is to provide a pressure boundary.

Staff Evaluation. The staff reviewed LRA Section 2.3.1 and UFSAR Sections 3.3, 3.4, 3.9, 4.2, and 4.3 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3, "Scoping and Screening Results: Mechanical Systems."

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

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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the RCS and CRD 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).

2.3.1.1 Reactor Vessel

2.3.1.1.1 Summary of Technical Information in the Application

LRA Section 2.3.1.1 describes the reactor vessel, which contains the nuclear fuel core, core support structures, control rods, and other parts of the reactor core. The major components of the reactor vessel include the reactor vessel shell, bottom head, upper closure head, flanges, studs, nuts, nozzles, and safe ends. Thermal sleeves attached to vessel nozzles or nozzle safe ends are included as are CRD stub tubes, CRD housings, in-core housings, vessel support skirt, vessel interior welded attachments, and vessel exterior welded attachments.

LRA Table 2.3.1-1 shows reactor vessel component types within the scope of license renewal and subject to an AMR:

- bolting
- heads shell
- nozzles and penetrations
- safe ends, thermal sleeves, caps, and flanges
- vessel attachments and supports

The reactor vessel component intended functions within the scope of license renewal include:

- pressure boundary
- structural or functional support for safety-related equipment

2.3.1.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.1 and the UFSAR using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

In LRA Table 2.3.1-1, the reactor vessel leakage monitoring piping is not shown as a component within the scope of license renewal requiring an AMR. In RAI 2.3.1.1-1 dated July 31, 2006, the staff requested that the applicant either identify the subject component as within the scope of license renewal and subject to an AMR or provide plant-specific justification for why the component need not be subject to an AMR.

In its response dated August 30, 2006, the applicant stated that the components were treated as parts of the RCPB, not the reactor vessel. The components were included as piping and fittings less than 4" nominal pipe size (NPS), orifices (instrumentation), and valve bodies less than 4" NPS in LRA Table 2.3.1-3, "Reactor Coolant Pressure Boundary Components Subject to Aging Management Review."

Based on its review, the staff finds the applicant's response to RAI 2.3.1.1-1 acceptable. The staff's concern described in RAI 2.3.1.1-1 is resolved.

In LRA Table 2.3.1-1, the scram discharge piping and volume were not identified as a component within the scope of license renewal and requiring an AMR. In RAI 2.3.1.1-2 dated July 31, 2006, the staff requested the applicant either identify the subject components as within the scope of license renewal and subject to an AMR, or provide plant-specific justification as to why the subject components need not be subject to AMR.

In its response dated August 30, 2006, the applicant stated that the subject components were treated as part of the reactor coolant pressure boundary, and not reactor vessel. The associated components were included as piping and fittings less than 4" NPS, piping and fittings greater than 4" NPS, and Valve bodies less than 4" NPS in LRA Table 2.3.1-3, "Reactor Coolant Pressure Boundary Components Subject to Aging Management Review."

Based on its review, the staff finds the applicant's response to RAI 2.3.1.1-2 acceptable. The staff's concern described in RAI 2.3.1.1-2 is resolved.

In RAI 2.3.1.1-3 dated July 31, 2006, the staff requested from the applicant an explanation as to why the CRD housing supports were not addressed in LRA Section 2.3.1.1 as they apparently were not considered within the scope for license renewal and subject to an AMR.

In its response dated August 30, 2006, the applicant stated that the subject components were considered in the structural elements and included in the line item for components and piping supports category of American Society of Mechanical Engineers (ASME) Classes 1, 2, 3 in Table 2.4-6, "Bulk Commodities Components Subject to AMR."

Based on its review, the staff finds the applicant's response to RAI 2.3.1.1-3 acceptable. The staff's concern described in RAI 2.3.1.1-3 is resolved.

2.3.1.1.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the reactor vessel components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.2 Reactor Vessel Internals

2.3.1.2.1 Summary of Technical Information in the Application

LRA Section 2.3.1.2 describes the reactor vessel internals, which are designed to distribute the reactor coolant flow delivered to the vessel, to locate and support the fuel assemblies, and to contain the core with an inner volume that can be flooded following a break in the nuclear system process barrier. The reactor vessel internals include the CR guide tubes, core plate, core spray lines, differential pressure and standby liquid control line, feedwater spargers, fuel support pieces, in-core dry tubes, in-core guide tubes, local power range monitors (LPRM), jet pump assemblies and jet pump instrumentation, shroud (including repair hardware), shroud head and steam separator assembly, shroud support, steam dryer, surveillance sample holders, and top guide.

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

- control rod guide tubes
- core plate assembly
- core spray lines
- SLC/ΔP line
- fuel support pieces
- in-core dry tubes
- in-core guide tubes
- jet pump assemblies
- shroud
- shroud repair hardware
- shroud support
- steam dryer
- top guide

The reactor vessel internal component intended functions within the scope of license renewal include:

- flow distribution
- boundary of a volume in which the core can be flooded and adequately cooled in a breach in the nuclear system process barrier external to the reactor vessel
- pressure boundary
- structural or functional support for safety-related equipment
- structural integrity so loose parts are not introduced

2.3.1.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.2 and the UFSAR using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

LRA Section 2.3.1.2, "Reactor Vessel Internals," states that the internals include LPRM. The staff understands that the neutron monitoring system includes additional neutron monitors (*e.g.*, intermediate range monitors, rod block monitors, etc.) and that these monitoring circuits and their electrical cables should be within the scope of license renewal and subject to an AMR. The staff also noted that LRA Table 2.2-1b indicates that a bounding approach was used for the NMS.

In RAI 2.3.1.2-1 dated July 31, 2006, the staff requested that the applicant clarify which neutron monitors and related cables are within the scope of license renewal based on the bounding approach.

In its response dated August 30, 2006, the applicant stated that all electrical and I&C commodities in electrical and mechanical systems are in-scope by default; therefore, the neutron monitoring components and related cables described in UFSAR Section 7.5 are within the scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.1.2-1 acceptable. The staff's concern described in RAI 2.3.1.2-1 is resolved.

2.3.1.2.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the reactor vessel 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).

2.3.1.3 Reactor Coolant Pressure Boundary

2.3.1.3.1 Summary of Technical Information in the Application

LRA Section 2.3.1.3 describes the RCPB, which maintains a high-integrity pressure boundary and fission product barrier from inside the primary containment to the first isolation valve outside the primary containment. The RCPB includes Class 1 piping attached to the vessel nozzles or safe ends, including welded joints, pumps, and boundary isolation valves. Also included are Class 2 piping not under another AMR, vents, drains, leak-off, sample lines, and instrumentation lines up to the transmitters. In addition, RCPB evaluation boundaries include pressure-containing fluid components which are parts of or connected to the RCS.

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

- bolting (flanges, valves, etc.)
- condensing chambers
- detector (CRD)
- drive (CRD)

- driver mount (reactor recirculation (RR))
- filter housing (CRD)
- flow elements (RR)
- orifices (instrumentation)
- piping and fittings < 4" NPS
- piping and fittings $\geq$ 4" NPS
- pump casing and cover (RR)
- restrictors (main steam)
- rupture disc (CRD)
- tank (CRD accumulator)
- thermowell (all systems)
- valve bodies < 4" NPS
- valve bodies $\geq$ 4" NPS

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

- flow control or spray pattern
- pressure boundary

2.3.1.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.3 and the UFSAR using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.1.3.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified RCPB components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2 Engineered Safety Features

LRA Section 2.3.2 identifies the engineered safety feature SCs subject to an AMR for license renewal.

The applicant described the supporting SCs of the engineered safety features in the following LRA sections:

- 2.3.2.1 residual heat removal system
- 2.3.2.2 core spray system
- 2.3.2.3 automatic depressurization
- 2.3.2.4 high pressure coolant injection
- 2.3.2.5 reactor core isolation cooling
- 2.3.2.6 standby gas treatment
- 2.3.2.7 primary containment penetrations

2.3.2.1 Residual Heat Removal System

2.3.2.1.1 Summary of Technical Information in the Application

LRA Section 2.3.2.1 describes the residual heat removal (RHR) system, which cools the core in conjunction with other core standby cooling systems (CSCSs) and the containment as required during abnormal operational transients and postulated accidents. The RHR system is designed for four modes of operation: (1) shutdown cooling, (2) low-pressure coolant injection, (3) suppression pool cooling, and (4) containment spray. The shutdown cooling mode completes cool-down of the nuclear system when steam supply pressure is no longer sufficient to maintain a vacuum in the main condenser. In low-pressure coolant injection mode, the RHR system operates in combination with other CSCSs to restore and, if necessary, maintain the coolant inventory in the reactor vessel after a loss of coolant accident (LOCA). Suppression pool cooling mode removes heat from the pressure suppression pool to reduce pressure in the primary containment following a LOCA. The containment spray mode provides containment spray capability as an alternate method for reducing containment pressure following a LOCA. A portion of the water pumped through the RHR heat exchanger can be diverted to spray headers in the drywell and above the suppression pool to condense steam and reduce containment pressure. The remaining portion of the water not used for the spray function returns to the suppression pool.

The RHR system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the RHR system could prevent satisfactory performance of a safety-related function. In addition, the RHR system performs FP functions.

LRA Tables 2.3.2-1 and 2.3.3-14-28 identify RHR system component types within the scope of license renewal and subject to an AMR:

- bolting
- condensing pots
- cyclone separator

- heat exchanger (bonnets)
- heat exchanger (shell)
- heat exchanger (tubes)
- orifice
- piping
- pump casing
- spray header
- spray nozzles
- strainer
- thermowell
- tubing
- valve body

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

- flow control or spray pattern
- filtration
- heat transfer
- pressure boundary

2.3.2.1.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.2.1 and 2.3.3.14, and UFSAR Sections 4.8 and 10.3 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The LPCI coupling was identified in the Boiling Water Reactor Vessel and Internals Project (BWRVIP)-06 report as a safety-related component. In RAI 2.3.2.1-1 dated July 31, 2006, the staff noted that LPCI couplings at PNPS should be identified in the LRA as within the scope of license renewal and subject to an AMR. In its response dated August 30, 2006, the applicant stated that PNPS has no LPCI couplings.

Based on its review, the staff finds the applicant's response to RAI 2.3.2.1-1 acceptable. The staff's concern described in RAI 2.3.1.1-1 is resolved.

In RAI 2.3.2.1-2 dated July 31, 2006, the staff requested clarification whether PNPS employs vortex breakers in the emergency core cooling system pump suction lines and, if so, classification of these passive components as within the scope of license renewal and subject to an AMR.

In its response dated August 30, 2006, the applicant stated that PNPS site documentation for all in-scope mechanical systems, including licensing basis and design basis documents as well as site drawings, indicates that no vortex breakers were required to support system intended functions within the scope of license renewal per 10 CFR 54.4(a)(1), (a)(2) or (a)(3). Therefore, vortex breakers were not included in the LRA.

Based on its review, the staff finds the applicant's response to RAI 2.3.2.1-2 acceptable. The staff's concern described in RAI 2.3.1.1-2 is resolved.

2.3.2.1.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance 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).

2.3.2.2 Core Spray System

2.3.2.2.1 Summary of Technical Information in the Application

LRA Section 2.3.2.2 describes the core spray system, which, with other CSCSs, provides adequate core cooling for all design-basis break sizes up to and including a double-ended break of the reactor recirculation system (RRS) piping. The core spray system protects the core in large breaks in the nuclear system when the feedwater system, CRD water pumps, the RCIC system, and the high-pressure coolant injection (HPCI) system cannot maintain reactor vessel water level. The protection also extends to small breaks in which the feedwater system, CRD water pumps, and RCIC and HPCI systems all cannot maintain the reactor vessel water level and the automatic depressurization system has operated to lower the reactor vessel pressure so low-pressure coolant injection and the core spray system can cool the core. The core spray system consists of two loops of motor-driven pumps and valves and piping delivering makeup water to the sparger ring in the reactor vessel.

The core spray system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the core spray system could prevent satisfactory performance of a safety-related function. In addition, the core spray system performs FP functions.

LRA Tables 2.3.2-2 and 2.3.3-14-7 identify core spray system component types within the scope of license renewal and subject to an AMR:

- bolting
- cooling coil
- cyclone separator
- orifice
- piping
- pump casing
- tubing
- valve body

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

- flow control or spray pattern
- filtration
- heat transfer
- pressure boundary

2.3.2.2.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.2.2 and 2.3.3.14, and UFSAR Section 6.4.3 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

Based on its review, the staff finds that the applicant has identified core spray system portions that meet the scoping requirements of 10 CFR 54.4 and has included them within the scope of license renewal in LRA Section 2.3.2.2. The applicant also has included core spray system components subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1) in LRA Table 2.3.2-2. The staff found no omissions.

2.3.2.2.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the core spray 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).

2.3.2.3 Automatic Depressurization

2.3.2.3.1 Summary of Technical Information in the Application

LRA Section 2.3.2.3 describes the automatic depressurization system, which reduces the nuclear system pressure so the low-pressure core cooling systems can reflood the core following certain postulated transients or accidents. The automatic depressurization system uses the four nuclear system pressure relief valves (safety relief valves (SRVs) to relieve the high-pressure steam to the suppression pool. The SRVs are installed with each valve discharge piped through its own uniform diameter discharge line to a point below the minimum water level in the primary containment suppression pool so the steam condenses in the pool. Water in the line above the suppression pool water level would cause excessive pressure on relief valve discharge piping when the valve reopens. For this reason, vacuum relief valves on each relief valve discharge line prevent influx of water from steam condensation into the line following termination of relief valve operation. Each of the four SRVs on the main steam piping is equipped with an air/nitrogen accumulator and check valve arrangement. These accumulators hold the valves open following failure of the air or nitrogen supply.

The automatic depressurization system has safety-related components relied upon to remain functional during and following DBEs. In addition, the automatic depressurization system performs FP functions.

LRA Table 2.3.2-3 shows automatic depressurization system component types within the scope of license renewal and subject to an AMR:

- *bolting*
- piping
- tee-quenchers (submerged)
- valve body

The automatic depressurization system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.2.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.3 and UFSAR Sections 4.4 and 6.4.2 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.2.3.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the automatic 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).

2.3.2.4 High Pressure Coolant Injection

2.3.2.4.1 Summary of Technical Information in the Application

LRA Section 2.3.2.4 describes the HPCI system, which cools the reactor core adequately under abnormal, transient, and postulated accident conditions, including a LOCA. The HPCI system maintains an adequate coolant inventory in the reactor pressure vessel in the event of a small break in the nuclear system and loss of coolant without rapid depressurization of the reactor vessel. The system is designed to accomplish its function in a short term without reliance on station auxiliary power supplies other than direct current power. The HPCI system consists of a turbine-driven pump, a gland seal condenser, piping, and valves. The turbine, supplied with reactor steam and exhausting to the torus, drives a pump assembly consisting of a main pump, reducing station, and booster pump. The pump suction header is supplied with water from the condensate storage tanks (preferred path) or the torus suppression pool (assured path). HPCI to the vessel is through a feedwater line.

The HPCI system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the HPCI system could prevent satisfactory performance of a safety-related function. In addition, the HPCI system performs FP functions.

LRA Tables 2.3.2-4 and 2.3.3-14-16 identify HPCI system component types within the scope of license renewal and subject to an AMR:

- bearing housing
- blower housing
- bolting
- drain pot
- filter housing
- gear box housing
- governor housing
- heat exchanger (bonnet)
- heat exchanger (shell)
- heat exchanger (tubes)
- orifice
- pilot valve housing
- piping
- pump casing
- rupture disc
- steam trap
- strainer
- strainer housing
- tank
- thermowell
- tubing
- turbine casing
- valve body

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

- flow control or spray pattern
- filtration
- heat transfer
- pressure boundary

2.3.2.4.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.2.4 and 2.3.3.14, and UFSAR Section 6 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The steam supply and return lines for HPCI and reactor core isolation cooling (RCIC) perform safety functions and, therefore, should be within the scope of license renewal and subject to an AMR in accordance with 10 CFR 50.4(a)(1). In RAI 2.3.2.4-1 dated July 31, 2006, the staff requested clarification whether the components are within the scope of license renewal.

In its response dated August 30, 2006, the applicant stated that the components are within the scope of license renewal and subject to an AMR. The applicant further stated that these lines support the intended functions of the HPCI system and are therefore subject to an AMR in accordance with 10 CFR 54.4(a)(1). Components in these lines were included in LRA Table 2.3.2-4, "High Pressure Coolant Injection System Components Subject to Aging Management Review." The RCIC system steam supply and return lines are within the scope of license renewal and subject to an AMR. They support the intended functions of the RCIC system and are therefore subject to an AMR in accordance with 10 CFR 54.4(a)(1). Components in these lines were included in LRA Table 2.3.2-5, "Reactor Core Isolation Cooling Components Subject to Aging Management Review."

Based on its review, the staff finds the applicant's response to RAI 2.3.2.4-1 acceptable. The staff's concern described in RAI 2.3.2.4-1 is resolved.

2.3.2.4.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the HPCI 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).

2.3.2.5 Reactor Core Isolation Cooling

2.3.2.5.1 Summary of Technical Information in the Application

LRA Section 2.3.2.5 describes the RCIC system, which provides makeup water to the reactor vessel during shutdown and isolation to supplement or replace the normal makeup sources and prevent the release of radioactive materials to the environs as a result of inadequate core cooling. The RCIC system operates completely independent of alternating current (AC) power and its capability, with that of other level control systems, enables complete plant shutdown following the loss of normal feedwater by maintaining sufficient reactor inventory until the reactor is depressurized and the shutdown cooling system placed in operation. The RCIC system consists of a steam turbine-driven pump, a barometric condenser for steam seal leakage, piping, and valves. The system is designed to supply water from the condensate storage tank or the suppression pool to the vessel via a feedwater line. To drive the turbine, it utilizes reactor steam which is exhausted into the suppression pool. Portions of this system extend the primary containment and also form parts of the RCPB.

The RCIC system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the RCIC system could prevent satisfactory performance of a safety-related function. In addition, the RCIC system performs FP functions.

LRA Tables 2.3.2-5 and 2.3.3-14-25 show RCIC system component types within the scope of license renewal and subject to an AMR:

- bolting
- condenser shell
- drain pot
- filter housing
- governor housing
- heat exchanger (bonnet)
- heat exchanger (shell)
- heat exchanger (tubes)
- orifice
- piping
- pump casing
- sight glass
- steam trap
- strainer
- strainer housing
- tank
- thermowell
- tubing
- turbine casing
- valve body

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

- flow control or spray pattern
- filtration
- heat transfer
- pressure boundary

2.3.2.5.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.2.5 and 2.3.3.14, and UFSAR Section 4.7 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

Based on its review, the staff finds that the applicant has identified those portions of the RCIC that meet the scoping requirements of 10 CFR 54.4 and has included them within the scope of license renewal in LRA Section 2.3.2.5. The applicant has also included RCIC components subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1) in LRA Table 2.3.2-5. The staff found no omissions.

2.3.2.5.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the RCIC 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).

2.3.2.6 Standby Gas Treatment

2.3.2.6.1 Summary of Technical Information in the Application

LRA Section 2.3.2.6 describes the standby gas treatment system (SGTS), which limits the release of radioactive materials to the environs to offsite doses from a postulated design-basis accident (DBA) below 10 CFR Part 100 guideline values. The SGTS is part of the secondary containment system which provides secondary containment for postulated LOCAs and primary containment for postulated refueling accidents. The SGTS consists of two full-capacity trains with dampers, an exhaust fan, and an air filtration assembly. The SGTS shares ducting with the various reactor building exhaust systems and can draw air from the reactor building clean and contaminated compartment exhausts, the refueling floor exhaust, and the drywell and suppression pool exhausts. After treatment, the air is discharged through a line of the underground vent duct system consisting of ducts, dampers, pipes, valves, and the 20-inch underground vent which transports gaseous effluent from the SGTS and the primary containment atmospheric control (PCAC) system to the main stack. A deluge spray wets down the charcoal beds in a fire. The spray components supply water to spray headers in each of the filtration trains. This piping forms part of the pressure boundary of the SGTS filter housing. Following an accident, the SGTS maintains a negative pressure inside the reactor building to minimize the ground-level release of fission products by ex-filtration. The SGTS also removes particulates and iodines by filtration from any release through the main stack.

The SGTS has safety-related components relied upon to remain functional during and following DBEs.

LRA Table 2.3.2-6 identifies SGTS component types within the scope of license renewal and subject to an AMR:

- bolting
- damper housing
- ductwork
- expansion joint
- fan housing
- filter housing
- orifice
- piping
- thermowell
- tubing
- valve body

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

- flow control or spray pattern
- pressure boundary

2.3.2.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.6 and UFSAR Section 5.3 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.2.6.3 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 components subject to an AMR.

The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the SGTS components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.7 Primary Containment Penetrations

2.3.2.7.1 Summary of Technical Information in the Application

LRA Section 2.3.2.7 describes the primary containment penetrations system, which rapidly isolates all pipes or ducts penetrating the primary containment for a containment barrier as effective as required to maintain leakage within permissible limits. Mechanical penetrations for systems with system-level AMRs are reviewed with that system. The scope of this review is passive mechanical penetration components not included in other system reviews.

The primary containment penetrations system has safety-related components relied upon to remain functional during and following DBEs.

LRA Table 2.3.2-7 identifies primary containment penetrations system component types within the scope of license renewal and subject to an AMR:

- bolting
- piping
- tubing
- valve body

The primary containment penetrations system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.2.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.7 and UFSAR Section 5.2 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

Based on its review, the staff finds that the applicant has identified primary containment penetrations system portions that meet the scoping and screening requirements of 10 CFR 54.4 and has included them within the scope of license renewal in LRA Section 2.3.2.7. The applicant has also included primary containment penetrations system components subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1) in LRA Table 2.3.2-7. The staff found no omissions.

2.3.2.7.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the primary containment penetrations 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).

2.3.3 Auxiliary Systems

LRA Section 2.3.3 indicates the auxiliary systems SCs subject to an AMR for license renewal.

The applicant described the supporting auxiliary system SCs in the following LRA sections:

- 2.3.3.1 standby liquid control (SLC)
- 2.3.3.2 SSW
- 2.3.3.3 RBCCW
- 2.3.3.4 EDG
- 2.3.3.5 SBO diesel generator system
- 2.3.3.6 security diesel
- 2.3.3.7 fuel oil
- 2.3.3.8 compressed air (instrument air)
- 2.3.3.9 FP-water
- 2.3.3.10 FP-Halon system
- 2.3.3.11 HVAC
- 2.3.3.12 primary containment atmosphere control system
- 2.3.3.13 fuel pool cooling and fuel handling and storage systems
- 2.3.3.14 miscellaneous systems in-scope for 10 CFR 54.4(a)(2)

The staff's findings on review of LRA Sections 2.3.3.1 - 2.3.3.14 are in SER Sections 2.3.3.1 - 2.3.3.14, respectively.

2.3.3.1 Standby Liquid Control

2.3.3.1.1 Summary of Technical Information in the Application

LRA Section 2.3.3.1 describes the standby liquid control (SLC) system, which injects a neutron-absorbing solution into the reactor to achieve and maintain subcriticality if not enough control rods can be inserted in the reactor core for shutdown and cool-down. The SLC system is an independent, diverse CRD system backup consisting of an SLC tank, a test tank, two pumps, two explosive-actuated valves, piping, and valves necessary to prepare and inject the neutron-absorbing solution into the reactor and to test itself. The liquid is piped into the reactor vessel and discharged near the bottom of the core shroud to mix with the cooling water rising through the core.

The SLC system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the SLC system could prevent satisfactory performance of a safety-related function. In addition, the SLC system performs ATWS functions.

LRA Tables 2.3.3-1 and 2.3.3-14-33 identify SLC system component types within the scope of license renewal and subject to an AMR:

- bolting
- heater housing
- piping
- pump casing
- tank
- thermowell
- tubing
- valve body

The SLC component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.1.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.3.1 and 2.3.3.14, and UFSAR Section 3.8 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.3.1.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the SLC 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).

2.3.3.2 Salt Service Water

2.3.3.2.1 Summary of Technical Information in the Application

LRA Section 2.3.3.2 describes the SSW system function as the ultimate heat sink for the RBCCW and turbine building closed cooling water (TBCCW) systems during plant operations.

The SSW system has five vertical service water pumps in the intake structure, piping, and valves. The SSW system consists of two open loops, each with two pumps (plus a common spare). In normal operation SSW pumps are operated with the cross-tie valves open. The pumps take suction from Cape Cod Bay and discharge to a common header supplying both loops. Each loop provides coolant to one RBCCW and one TBCCW heat exchanger. The water from the outlet of the heat exchangers returns to the bay, the ultimate heat sink. Following a LOCA, only one SSW system loop is required. The SSW system can supply water to the screen wash pumps to clean the traveling water screens and to the Triplex filter as an alternate supply of coolant to the circulating water pumps. The SSW system also provides a permanent piping connection from the SSW pumps to the RHR system as an additional source of water to cool the reactor when directed by emergency operating procedures for a severe accident beyond the plant design basis.

The SSW system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the SSW system could prevent satisfactory performance of a safety-related function. Nonsafety-related portions with the potential to affect safety-related systems or components adversely are reviewed with miscellaneous systems within the scope of license renewal for 10 CFR 54.4(a)(2) (LRA Section 2.3.3.14). In addition, the SSW system performs FP functions.

LRA Tables 2.3.3-2 and 2.3.3-14-29 identify SSW component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- heat exchanger (tubes)
- heat exchanger (shell)
- orifice
- piping
- pump casing
- thermowell
- tubing
- valve body

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

- flow control or spray pattern
- pressure boundary

Note: The RBCCW heat exchangers are evaluated with the RBCCW system (LRA Section 2.3.3.3).

2.3.3.2.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.3.2 and 2.3.3.14, and UFSAR Section 10.7 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.2 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.2-1 dated July 31, 2006, the staff stated that the sluice gates and slide gates are shown as within the scope of license renewal and subject to an AMR but do not appear in LRA Table 2.3.3-2 as a component type subject to an AMR. Therefore, the staff asked the applicant to clarify whether these gates are components subject to an AMR.

In its response dated August 30, 2006, the applicant stated that the gates noted in RAI 2.3.3.2-1 are included in Table 2.3.3-2 for the SSW system under the generic component type "valve body" because they act as valves by isolating flow. Additionally, the applicant stated that the gates are shown in Table 3.3.2-2 as valve bodies comprised of carbon steel with internal and external environments of raw water. The applicant added that the Service Water Integrity Program manages aging effects for the gates.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.2-1 acceptable because it gave details which clarified that the sluice gates are shown adequately on Tables 2.3.3-2 and 3.3.2-2 and therefore are subject to AMR. The staff's concern described in RAI 2.3.3.2-1 is resolved.

In RAI 2.3.3.2-2 dated July 31, 2006, the staff stated that FSAR Section 10.7 implies that the baffle plates have an intended function in accordance with 10 CFR 54.4(a) but they are not shown as within the scope of license renewal, nor do they appear to be shown in LRA Table 2.3.3-2 as a component type subject to an AMR. Therefore, the staff asked the applicant to clarify whether the baffle plates are subject to an AMR.

In its response dated August 30, 2006, the applicant stated that the baffle plates noted in RAI 2.3.3.2-2 were installed as an enhancement to improve flow conditions and to reduce hydraulic forces on the pumps. Additionally, the applicant explained that the SSW pumps and intake structure can perform their intended function without the baffle plates and, therefore, the baffle plates are not subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.2-2 acceptable because it adequately explained that the baffle plates perform no intended function, were installed as enhancements to the SSW pumps and intake structure, and are therefore not subject to an AMR. The staff's concern described in RAI 2.3.3.2-2 is resolved.

In RAI 2.3.3.2-3 dated July 31, 2006, the staff stated that the air vents and connected piping were shown as subject to an AMR. The internal environment of these components is air; however, LRA Table 3.3.2-2 has no entry for the component type "piping" with an internal environment of air. Therefore, the staff asked the applicant to clarify whether the air vents and the downstream piping are included in component type "piping" or to add them to LRA Tables 2.3.3-2 and 3.3.2-2.

In its response dated August 30, 2006, the applicant stated that the air vents and downstream piping noted in RAI 2.3.3.2-3 are included in the SSW system review and subject to an AMR. Additionally, the applicant stated that the components are included in LRA Tables 2.3.3-2 and 3.3.2-2 as "valve body" and "piping" with a conservative internal environment of "raw water" specified because it would be the normal environment when the pumps are in operation.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.2-3 acceptable because it adequately explained that the valves and downstream piping identified, are subject to an AMR and included in Tables 2.3.3-2 and 3.3.2-2 as "valve body" and "piping" with an internal environment of "raw water." Therefore, the staff's concern described in RAI 2.3.3.2-3 is resolved.

2.3.3.2.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the SSW 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).

2.3.3.3 Reactor Building Closed Cooling Water

2.3.3.3.1 Summary of Technical Information in the Application

LRA Section 2.3.3.3 describes the RBCCW system, which cools essential and nonessential equipment including CSCS components, the equipment area cooling system, RHR heat exchangers, fuel pool heat exchangers, CRD pumps, and RR pumps as required and provides a barrier between the primary system and the SSW system. Portions of the system penetrating the primary containment form an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment. The RBCCW system consists of two independent closed loops for redundancy during accident conditions. Each loop has three parallel pump trains, one heat exchanger, one surge tank, and a chemical addition tank. The two loops normally are isolated from each other but can be connected through cross-tie headers. RBCCW system portions designated as ASME Class 1 pressure boundary only are seismic Class 1 in their ability to retain their integrity (pressure boundary) and prevent loss of water during and after seismic events. Components designated ASME Class 1 pressure boundary only supply nonessential heat loads under accident conditions.

The RBCCW system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the RBCCW system could prevent satisfactory performance of a safety-related function. Nonsafety-related portions with the potential to affect safety-related systems or components adversely (10 CFR 54.4(a)(2)) are reviewed with miscellaneous systems within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) (LRA Section 2.3.3.14). In addition, the RBCCW system performs fire protection functions.

LRA Tables 2.3.3-3 and 2.3.3-14-24 show RBCCW component types within the scope of license renewal and subject to an AMR:

- bolting
- heat exchanger (bonnets)
- heat exchanger (housing)
- heat exchanger (shell)
- heat exchanger (tubes)
- orifice
- piping
- pump casing
- sample chamber
- strainer housing
- tank
- thermowell
- tubing
- valve body

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

- heat transfer
- pressure boundary
- structural or functional support for safety-related equipment

Note: Heat exchangers cooled by RBCCW are evaluated in various AMRs. Recirculation pump coolers are included in LRA Section 2.3.1.3, RHR heat exchanger and seal coolers in LRA Section 2.3.2.1, core spray pump motor bearing coolers in LRA Section 2.3.2.2 and HPCI and RCIC pump area coolers in LRA Section 2.3.3.11.

2.3.3.3.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.3.3 and 2.3.3.14, and UFSAR Section 10.5 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.3 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.3-1 dated July 31, 2006, the staff stated that flexible hose and flexible connections are shown on various license renewal drawings at certain locations as within the scope of license renewal and subject to an AMR. In LRA Section 2.1.2.1.3, the applicant stated that "flexible hoses that are periodically replaced (not long-lived) and therefore not subject to aging management, are indicated on the drawings." The staff noted that the flexible hoses perform an intended function of pressure boundary to various components supplied with RBCCW; however, the staff also noted that there are no flexible hoses shown as a component type in LRA Table 2.3.3-3. Therefore, the staff asked the applicant to justify the exclusion from the table of flexible hoses as a component type,

In its response dated October 6, 2006, the applicant stated that flexible hoses in the RBCCW system are replaced after a specified time period and are, therefore, not subject to an AMR. The applicant further stated that the hoses highlighted on license renewal drawings LRA-M-215 sheets 1, 2, and 4 incorrectly show flexible connections as subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.3-1 acceptable because it adequately explained that flexible hoses in the RBCCW system are replaced periodically, and license renewal drawings LRA-M-215, sheets 1, 2, and 4 incorrectly show flexible connections as subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.3-1 is resolved.

In RAI 2.3.3.3-2, the staff stated that flow elements are shown on license renewal drawings as within the scope of license renewal for the RBCCW system and subject to an AMR. Additionally, the staff noted that LRA Table 2.3.3-3 does not show the component type flow element. However, because it believes that flow elements have a flow control intended function, the staff asked the applicant to justify the exclusion of flow elements with an intended function of flow control from LRA Table 2.3.3-3.

In its response dated August 30, 2006, the applicant stated that the flow elements noted in RAI 2.3.3.3-2 are not credited with an intended function of controlling flow to support system intended functions. The applicant explained that the flow elements only indicate flow, have no control, and, therefore, have no component intended function of flow control. Therefore, pressure boundary is their only component intended function. Additionally, the applicant stated that an orifice credited with reducing system flow would have flow control included in its component intended functions.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.3-2 acceptable because it adequately explained that the flow elements support no system intended function other than pressure boundary because the system does not rely on control functions by the flow elements. Additionally, the applicant adequately explained that, if the flow elements provided a control function to support system intended functions, flow control would have been included as a component intended function. Therefore, the staff's concern described in RAI 2.3.3.3-2 is resolved.

In RAI 2.3.3.3-3 dated July 31, 2006, the staff stated that Y-strainers -4074 and -4078 are shown on license renewal drawings as within the scope of license renewal for the RBCCW system and subject to an AMR. Additionally, the staff noted that, although LRA Table 2.3.3-3 shows strainers with a pressure boundary intended function, the table does not show a strainer with a filtration intended function. Because it believes that strainers perform a filtration intended function, the staff asked the applicant to justify the exclusion of filtration as an intended function from LRA Table 2.3.3-3.

In its response dated August 30, 2006, the applicant stated that the Y-strainers noted in RAI 2.3.3.3-3 are not credited with an intended function of filtration to support system intended functions. The applicant explained that the Y-strainers only support the ability to draw samples, not an RBCCW system intended function; therefore, pressure boundary is their only component intended function.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.3-3 acceptable because it adequately explained that the identified Y-strainers support no system intended function other than pressure boundary because the system does not rely on the Y-strainers' filtration component intended function. Therefore, the staff's concern described in RAI 2.3.3.3-3 is resolved.

In RAI 2.3.3.3-4 dated July 31, 2006, the staff stated that restricting orifices RO-4019 and RO-4017 are shown on license renewal drawings as within the scope of license renewal for the RBCCW system and subject to an AMR. Additionally, the staff noted that, although LRA Table 2.3.3-3 includes a component type of orifice with a pressure boundary intended function, the table shows no orifice with a flow control intended function. Because it believes that orifices perform a flow control intended function, the staff asked the applicant to justify the exclusion of flow control as an intended function from LRA Table 2.3.3-3.

In its response dated August 30, 2006, the applicant stated that the restricting orifices noted in RAI 2.3.3.3-4 are not credited with an intended function of controlling flow to support system intended functions but perform a pressure boundary component intended function because the shielded sample chambers do not rely on flow control for successful performance of their function. The applicant added that the sample chambers perform no system license renewal intended function. Therefore, pressure boundary is the only component intended function for the restricting orifices.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.3-4 acceptable because it adequately explained that the restricting orifices support no system intended function other than pressure boundary because the system does not rely on flow control functions by the restricting orifices. Therefore, the staff's concern described in RAI 2.3.3.3-4 is resolved.

2.3.3.3.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the RBCCW 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).

2.3.3.4 Emergency Diesel Generator

2.3.3.4.1 Summary of Technical Information in the Application

LRA Section 2.3.3.4 describes the EDG system that provides the necessary power to safely shut down the reactor after a loss of offsite power. Each of the diesel generators can carry the loads necessary for a safe plant shutdown and is designed to start automatically on remote signals and come up to generator operating speeds and voltages ready to assume the loads. This system includes the diesel generator units and supporting subsystems, including jacket cooling water, lubricating oil, starting air, and the turbo-boost assist air system. EDG components containing fuel oil are evaluated separately as parts of the fuel oil storage and transfer system. The jacket water subsystem, which consists of several components of a closed cooling water loop, removes excess heat from the engine and its supporting auxiliary equipment. The main loop is the jacket water cooling loop, which removes excess heat from the EDG. Other sub-loops cool the compressed combustion air, the turbocharger, and the EDG lube oil. Jacket water temperature is regulated by flow control through air-cooled radiators. The starting air and turbo-boost air assist systems support EDG startup and operation. Each EDG engine is started by high-pressure air, which powers the air motors to crank the engine and start combustion. The turbo-boost assist air system supplies air to the turbocharger when needed.

The EDG system has safety-related components relied upon to remain functional during following DBEs. The failure of nonsafety-related SSCs in the EDG could prevent satisfactory performance of a safety-related function. In addition, the EDG system performs FP functions.

LRA Tables 2.3.3-4 and 2.3.3-14-8 show EDG component types within the scope of license renewal and subject to an AMR:

- air motor housing
- bolting
- compressor housing
- expansion joint (exhaust flex joint)
- filter housing
- fogger housing
- heat exchanger (bonnet)
- heat exchanger (shell)
- heat exchanger (tubes)
- heater housing
- orifice
- piping
- pump casing
- rack booster housing
- sight glass
- silencer
- strainer housing
- strainer
- tank
- thermowell
- tubing

- turbocharger housing
- valve body

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

- flow control or spray pattern
- filtration
- heat transfer
- pressure boundary

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.3.4 and 2.3.3.14, and UFSAR Section 8.5 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

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

In RAI 2.3.3.4-1 dated July 31, 2006, the staff stated that, according to the FSAR, engine freeze protection is provided by the jacket water cooling system heater; however, this heater is not shown as a component subject to an AMR. As this heater provides a pressure boundary for the jacket water cooling system and the pressure-retaining portion of the heater is a passive, long-lived component, the staff asked the applicant to justify the exclusion of the heater housing from an AMR.

In its response dated August 30, 2006, the applicant stated that this component is within the scope of license renewal, subject to an AMR, and included in LRA Table 3.3.2-4 under the component type of heater housing with treated water as its environment.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-1 acceptable because it adequately explained that the jacket water cooling system heater is within the scope of license renewal and subject to AMR. Further, the applicant explained that this component is in LRA Table 3.3.2-4 under the component type of heater housing with treated water as its environment. Therefore, the staff's concern described in RAI 2.3.3.4-1 is resolved.

In RAI 2.3.3.4-2 dated July 31, 2006, the staff stated that two after-coolers are shown as within the scope of license renewal and subject to an AMR but that after-cooler does not appear in LRA Table 2.3.3-4 as a component type subject to an AMR. Therefore, the staff asked the applicant to confirm that after-cooler is a component type subject to an AMR or to justify its exclusion.

In its response dated August 30, 2006, the applicant adequately explained that the after-coolers are shell and tube type heat exchangers subject to an AMR and included in LRA Tables 2.3.3-4 and 3.3.2-4 under the component type of heat exchanger (shell) and heat exchanger (tubes) with intended functions of heat transfer and pressure boundary.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-2 acceptable because it adequately explained that the after-coolers are shell and tube type heat exchangers subject to an AMR. Further, the applicant explained that this component is in LRA Tables 2.3.3-4 and 3.3.2-4 under the component type heat exchanger (shell) and heat exchanger (tubes) with intended functions of heat transfer and pressure boundary. Therefore, the staff's concern described in RAI 2.3.3.4-2 is resolved.

In RAI 2.3.3.4-3 dated July 31, 2006, the staff stated that two turbochargers are shown as within the scope of license renewal and subject to an AMR. The turbocharger is cooled by the jacket water cooling system. However, LRA Tables 2.3.3-4 and 3.3.2-4 do not show "heat transfer" as an intended function and treated water as an internal environment; therefore, the staff asked the applicant to explain why "heat transfer" is not an intended function of the turbocharger and why the cooling water of the jacket cooling water system is not an internal environment for the turbocharger.

In its response dated August 30, 2006, the applicant stated that the turbocharger (including housing) interface with the jacket water cooling system had been omitted inadvertently from the LRA. Further, the applicant stated that the intended function of heat transfer had been added to Table 2.3.3-4 for component type turbocharger housing and Table 3.3.2-4 had been revised to add additional line items for component type turbocharger housing.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-3 acceptable because it adequately explained that the turbocharger (including housing) interface with the jacket water cooling system had been omitted inadvertently from the LRA. Further, the applicant revised the LRA to add the intended function of heat transfer to LRA Table 2.3.3-4 for component type turbocharger and revised LRA Table 3.3.2-4 to add two AMR evaluations under the component type of carbon steel turbocharger exposed to treated water, one with the intended function of heat transfer and the other with the intended function of pressure boundary. Therefore, the staff's concern described in RAI 2.3.3.4-3 is resolved as this is considered to be an isolated omission.

In RAI 2.3.3.4-4 dated July 31, 2006, the staff stated that various license renewal drawings show flexible hose and flexible connections at certain locations as within the scope of license renewal and subject to an AMR. LRA Section 2.1.2.1.3 states that periodically replaced "flexible hoses" (not long-lived) and therefore not subject to an AMR are on the drawings. The hoses are not on the drawings as "not a long-lived component." Therefore, the staff asked the applicant to confirm that the flexible connections and hoses are long-lived and, therefore, subject to an AMR.

In its response dated August 30, 2006, the applicant stated that all EDG flex hoses are replaced after a specified time period and are, therefore, not subject to an AMR. The applicant further explained that the hoses noted in RAI 2.3.3.4-4 and highlighted on license renewal drawings LRA-M-259 and LRA-M-271 should not be highlighted.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-4 acceptable because it adequately explained that all EDG flex hoses are replaced after a specified time period and are, therefore, not subject to an AMR. Further, the applicant explained that the hoses highlighted on license renewal drawings LRA-M-259 and LRA-M-271 should not be highlighted. Therefore, the staff's concern described in RAI 2.3.3.4-4 is resolved.

In RAI 2.3.3.4-5 dated July 31, 2006, the staff stated that the EDGs are equipped with crankcase exhausters the failure of which can impact the EDG function adversely; however, the exhauster is not shown as a component subject to an AMR. Therefore, the staff asked the applicant to explain why the exhausters are not subject to an AMR.

In its response dated October 6, 2006, the applicant stated that the crankcase exhauster is not shown on the drawing because the crankcase exhauster assembly is mounted on the cylinder block and considered part of the diesel engine. The applicant further stated that, in accordance with NEI 95-10, Revision 6, Appendix B, emergency diesel engines do not meet 10 CFR 54.21(a)(1)(I) because they are active and are not subject to an AMR. The effects of aging on component parts of the active diesel engine are managed under the Maintenance Rule, 10 CFR 50.65. The applicant further explained that "crankcase exhauster" labels on license renewal drawing LRA-M-272-0 indicate only that the jacket water pressure switches (PS-JWPS-4A, B) send an engine running signal to the crankcase exhauster motors, not that the crankcase exhausters are external to the engine. Each crankcase exhauster, driven by an electric motor, is a centrifugal blower which exhausts crankcase vapors to the atmosphere.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-5 acceptable because it adequately explained that the crankcase exhauster is part of the diesel engine, which is active and, therefore, not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.4-5 is resolved.

In RAI 2.3.3.4-6 dated July 31, 2006, the staff stated that jacket water radiators are shown as within the scope of license renewal and subject to an AMR. FSAR Section 10.9.3.9 states that, "The EDG jacket water pump circulates the engine coolant through the radiator tubes where it transfers engine heat to the air. The engine-driven fan draws suction through each of the parallel radiators and discharges the heated air through a cylindrical discharge duct which exits at the roof." The staff asked the applicant to state whether the jacket water radiators contain fins for heat transfer and, if so, whether the fins are subject to an AMR.

In its response dated August 30, 2006, the applicant stated that the jacket water radiator tubes noted in RAI 2.3.3.4-6 have fins integral with the tubes and are of the same material as the tubes and subject to an AMR. The applicant further stated that, because the material for the fins and tubes are the same, the fins are not shown as a separate component but included with the heat exchanger (tubes) (intended function - Heat transfer, environment - Air outdoor (ext)) line item in Table 3.3.2-4.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-6 acceptable because it adequately explained that the fins, which are integral to the jacket water radiator tubes and the same material as the tubes, are subject to an AMR. Further, the applicant explained that the fins are not shown as a separate component because they are included with the AMR line item in Table 3.3.2-4 for copper alloy heat exchanger tubes exposed to outdoor air with an intended function of heat transfer. Therefore, the staff's concern described in RAI 2.3.3.4-6 is resolved.

2.3.3.4.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the EDG components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.5 Station Blackout Diesel Generator System

2.3.3.5.1 Summary of Technical Information in the Application

LRA Section 2.3.3.5 describes the SBO diesel generator system, which provides the necessary power to maintain the plant in a safe condition after loss of offsite power and the EDGs. The SBO diesel generator can supply either 4160 volts alternating current emergency bus but not both emergency busses at the same time. This system includes the diesel generator unit and supporting subsystems, including jacket cooling water, lubricating oil, and starting air. The jacket cooling water subsystem supports operation of the SBO diesel generator by removing excess heat from the engine and its supporting auxiliary equipment. The jacket cooling water subsystem consists of several components of a closed cooling water loop. The main loop is the jacket water cooling loop, which removes excess heat from the SBO diesel generator. Other sub-loops cool the compressed combustion air, the turbocharger, and the SBO diesel generator lube oil. Jacket water temperature is regulated by flow control through air-cooled radiators. The SBO diesel generator air start system supports the startup and operation of the SBO diesel generators. The SBO engine is started by high-pressure air, which powers the air motors to crank the engine and start combustion.

The SBO diesel generator system performs SBO functions.

LRA Table 2.3.3-5 identifies SBO diesel generator system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- heat exchanger (bonnet)
- heat exchanger (fins)
- heat exchanger (shell)
- heat exchanger (tubes)
- heater housing
- lubricator housing
- motor housing
- piping
- pump casing
- radiator box header
- radiator tubes
- sight glass

- silencer
- strainer housing
- strainer
- tank thermowell
- tubing
- turbocharger
- valve body

The SBO diesel generator system component intended functions within the scope of license renewal include:

- filtration
- heat transfer
- pressure boundary

2.3.3.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.5 and UFSAR Section 8.10 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

That staff's review of LRA Section 2.3.3.5 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.5-1 dated July 31, 2006, the staff stated that the following components are shown as within the scope of license renewal and subject to an AMR: starting rack booster housing, jacking gear air interrupter, de-aerator housing, air cleaner housing, and a drain trap but not specifically identified in LRA Table 2.3.3-5 as components subject to an AMR. Therefore, the staff asked the applicant to confirm that these components are subject to an AMR or to justify their exclusion.

In its response dated August 30, 2006, the applicant stated that the components noted in RAI 2.3.3.5-1 are subject to an AMR and included in LRA Table 2.3.3-5 as the following component types:

- the starting rack booster housing as component type "piping"
- the jacking gear air interrupter as component type "valve body"
- the deaerator housing as component type "tank"
- air cleaner housing as component type "filter housing"
- the drain trap as component type "valve body"

Based on its review, the staff finds the applicant's response to RAI 2.3.3.5-1 acceptable because it confirmed that the components in RAI 2.3.3.5-1 are subject to an AMR and identified how these components are included in LRA Table 2.3.3-5. Therefore, the staff's concern described in RAI 2.3.3.5-1 is resolved.

In RAI 2.3.3.5-2 dated July 31, 2006, the staff stated that a turbocharger is shown as within the scope of license renewal and subject to an AMR. LRA Section 2.3.3.5 and the corresponding license renewal drawing indicate that the turbocharger is cooled by the jacket water cooling system. However, LRA Tables 2.3.3-5 and 3.3.2-5 do not list "heat transfer" as an intended function and treated water as an internal environment. Therefore, the staff asked the applicant to explain why heat transfer is not an intended function and why the cooling water of the jacket cooling water system is not an internal environment of the turbocharger.

In its response dated August 30, 2006, the applicant stated that the turbocharger interface with the jacket water cooling system was omitted inadvertently from the LRA. Further, the applicant stated that the intended function of heat transfer had been added to Table 2.3.3-5 for component turbocharger and Table 3.3.2-5 also had been revised to add heat transfer and pressure boundary intended function line items for component type turbocharger.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.5-2 acceptable because it adequately explained that the turbocharger interface with the jacket water cooling system had been omitted inadvertently from the LRA. Further, the applicant revised the LRA to add the intended function of heat transfer to Table 2.3.3-5 for component type turbocharger and revised LRA Table 3.3.2-5 to add two AMR evaluations under the component type carbon steel turbocharger exposed to treated water, one with the intended function of heat transfer and the other with the intended function of pressure boundary. Therefore, the staff's concern described in RAI 2.3.3.5-2 is resolved.

In RAI 2.3.3.5-3 dated July 31, 2006, the staff listed flexible connections shown as within the scope of license renewal and subject to an AMR. LRA Section 2.1.2.1.3 states that "flexible elastomer hoses/expansion joints that are periodically replaced (not long-lived) and therefore not subject to aging management review are indicated as such on the drawings." The flexible connections listed in RAI 2.3.3.5-3 are not shown specifically on the drawings as "not a long-lived component." Therefore, the staff asked the applicant to confirm that these flexible connections are long-lived and, therefore, subject to an AMR.

In its response dated August 30, 2006, the applicant stated that the flexible hoses noted in RAI 2.3.3.5-3 for the SBO diesel generator are replaced after a specified time period and, therefore, not subject to an AMR. The applicant further stated that license renewal drawing LRA-M-264-0 incorrectly shows flexible connections as subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.5-3 acceptable because it adequately explained that flexible hoses for the SBO diesel generator are replaced after a specified time period and therefore not subject to an AMR. Further, the applicant explained that license renewal drawing LRA-M-264-0 incorrectly shows flexible connections as subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.5-3 is resolved.

In RAI 2.3.3.5-4 dated July 31, 2006, the staff stated that jacket water immersion heaters are shown on a license renewal drawing as not within the scope of license renewal. As this heater provides a pressure boundary for the jacket water cooling system and the pressure-retaining portion of the heater is a passive, long-lived component, the staff asked the applicant to justify the exclusion of the heater housing from an AMR.

In its response dated August 30, 2006, the applicant stated that the immersion heaters noted in RAI 2.3.3.5-4 are included in the component type "heater housing" in Tables 2.3.3-5 and 3.3.2-5.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.5-4 acceptable because it adequately explained that the jacket water immersion heaters are within the scope of license renewal and subject to an AMR. Further, the applicant explained that these components are included in LRA Tables 2.3.3-5 and 3.3.2-5 under the component type of heater housing. Therefore, the staff's concern described in RAI 2.3.3.5-4 is resolved.

2.3.3.5.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the SBO diesel generator 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).

2.3.3.6 Security Diesel

2.3.3.6.1 Summary of Technical Information in the Application

LRA Section 2.3.3.6 describes the security diesel system, which provides equipment necessary for site security. The security diesel system includes the security diesel, which provides necessary lighting for certain areas credited in the 10 CFR Part 50, Appendix R, safe shutdown analysis.

The security diesel system performs FP functions.

LRA Table 2.3.3-6 shows security diesel system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- heat exchanger (radiator)
- heat exchanger (shell)
- heat exchanger (tubes)
- piping
- pump casing
- silencer
- tubing

- turbocharger

The security diesel system component intended functions within the scope of license renewal include:

- heat transfer
- pressure boundary

2.3.3.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.6 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During the staff's review of LRA Section 2.3.3.6, the staff identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. LRA Section 2.3.3.6 states that the security diesel is within the scope of license renewal under 10 CFR 54.4(a)(3). LRA Table 2.3.3-6 shows the component types subject to an AMR but the security diesel system was not in the FSAR or in any license renewal drawings; therefore, the staff could not determine the portion of the security diesel system within the scope of license renewal. Additionally, the staff could not determine whether any components within the scope of license renewal were not shown as subject to an AMR. This item was identified as Open Item (OI) 2.3.3.6 in the SER with OI issued in March 2007.

Subsequently, the staff performed a system walkdown of the security diesel generator to verify that the licensee had accurately addressed the scoping and screening of the system in the LRA, specifically within Section 2.3.3.6, Table 2.3.3-6. The staff did not identify any deficiencies in the licensee description of the components relative to scope under 10 CFR 54.4(a)(3), and verified that except for the security diesel generator, there are no safety-related SSCs in the diesel generator enclosure or in proximity to the security diesel generator. Based on this information, the staff concludes that the applicant has correctly identified the security diesel generator system SSCs that are within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1), and open item (OI) 2.3.3.6 is closed.

2.3.3.6.3 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 components subject to an AMR. The staff finds no such omissions.

On the basis of its review, as discussed above, and pending resolution of OI 2.3.3.6, the staff concludes with reasonable assurance 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 those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.7 Fuel Oil

2.3.3.7.1 Summary of Technical Information in the Application

LRA Section 2.3.3.7 describes the diesel fuel oil system, which stores fuel oil and transfers it to various plant systems. The system includes bulk storage tanks, day tanks, transfer pumps, piping, and valves to provide fuel to the EDGs, SBO diesel, diesel fire pump, security diesel generator, and the plant heating boilers.

The diesel fuel oil system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the diesel fuel oil system could prevent satisfactory performance of a safety-related function. Nonsafety-related portions with the potential to affect safety-related systems or components adversely (10 CFR 54.4(a)(2)) are reviewed with miscellaneous systems within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) (LRA Section 2.3.3.14). In addition, the fuel oil system performs FP and SBO functions.

LRA Tables 2.3.3-7 and 2.3.3-14-13 show diesel fuel oil system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- flame arrester
- heater housing
- injector housing
- piping
- pump casing
- strainer
- strainer housing
- tank
- thermowell
- tubing
- valve body

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

- flow control or spray pattern
- filtration
- pressure boundary

2.3.3.7.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.3.7 and 2.3.3.14, and UFSAR Sections 8.5, 8.10, and 10.8 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

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

In RAI 2.3.3.7-1 dated July 31, 2006, the staff stated that the equipment for transferring fuel from the SBO diesel generator tanks to the EDG storage tanks functionally supports the EDGs, which are safety-related equipment, and should be within the scope of license renewal and subject to an AMR. Therefore, the staff asked the applicant to verify that passive, long-lived components of this equipment are subject to an AMR.

In its response dated August 30, 2006, the applicant stated that the diesel fuel oil emergency transfer skid noted in RAI 2.3.3.7-1 for emergency transfer of fuel oil from the SBO diesel generator tanks to the EDG storage tanks had been omitted inadvertently from the AMR. The applicant further explained that the pre-staged equipment includes the following passive, long-lived components subject to an AMR: a pump casing, piping and fittings, bolting, valve bodies, tubing, a hose coupling, a strainer, and hoses and that, because Table 2.3.3-7 already includes most of the component types and fittings are included in the piping line item, Table 2.3.3-7 was revised to include hose and hose coupling with a pressure boundary function. Additionally, the applicant added the following component types for new combinations of material, environment, aging effects and aging management programs (AMPs) as line items to Table 3.3.2-7, "Fuel Oil System (FO) Summary of Aging Management Evaluation:"

- hose, hose coupling, piping, pump casing, strainer, tubing, valve body

Further, the applicant's response stated that it made several changes to the LRA as results of the omission. The applicant described the first change:

> In item 1 under LRA Paragraph 3.3.2.2.5, "Hardening and Loss of Strength due to Elastomer Degradation," the applicant revised the paragraph to include the diesel fuel oil emergency transfer skid elastomer components. In this item the applicant included hoses on the diesel fuel oil emergency transfer skid exposed to air-indoor as requiring aging management. The applicant stated that the aging effects for these hoses are managed by the Periodic Surveillance and Preventive Maintenance (PSPM) Program which includes visual inspections and physical manipulation of the flexible connections to confirm that the components are not experiencing any aging that would affect accomplishing their intended functions.

The applicant described the second change:

> Line item 3.3.1-58 in Table 3.3.1, "Summary of Aging Management Programs for the Auxiliary Systems Evaluated in Chapter VII of NUREG-1801," was revised to credit the periodic surveillance and preventive maintenance program for managing loss of material for steel components on the diesel fuel oil emergency transfer skid.

The applicant also revised LRA Section A.2.1.26, "Periodic Surveillance and Preventive Maintenance Program," and added to the list of components for which periodic inspections by visual or other non-destructive examination techniques verify that the components are capable of performing intended functions, the following components: diesel fuel oil emergency transfer skid hoses, piping, pump casing, strainer, and valve bodies.

The applicant's response added to the LRA Section B.1.24, "Periodic Surveillance and Preventive Maintenance," the following activity:

fuel oil system	Use visual or other NDE techniques to inspect diesel fuel oil emergency transfer skid steel components to manage internal and external loss of material. Visually inspect and manually flex diesel fuel oil emergency transfer skid hoses to manage cracking and change in material properties.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-1 acceptable because it explained that the passive, long-lived components for the diesel fuel oil emergency transfer skid had been inadvertently omitted from AMR and detailed the revisions to LRA Tables 2.3.3-7 and 3.3.2-7 to include these items and other LRA changes to add these items to the AMR program. AMR programs are reviewed in SER Section 3. Therefore, the staff's concern described in RAI 2.3.3.7-1 is resolved as this is considered to be an isolated omission.

In RAI 2.3.3.7-2 dated July 31, 2006, the staff stated that UFSAR Section 8.5.2 describes a hydro-turbine that drives the backup diesel fuel transfer pump. In LRA Section 2.3.3.14, the applicant stated, "Unless specifically excluded, all nonsafety-related components in a system determined to be in-scope for 54.4(a)(2) for spatial interaction are subject to AMR. Components are excluded from review if their location is such that safety-related equipment cannot be impacted by component failure." Therefore, the hydro-turbine driven pump apparently should be within the scope of license renewal in accordance with 10 CFR 54.4(a)(2); however, LRA Tables 2.3.3-14-12 and 3.3.2-14-12 do not include component type pump casing with an appropriate material and environment combination subject to an AMR. Therefore, the staff asked the applicant to justify the exclusion of the hydro-turbine portion of the diesel fuel transfer pump from the scope of license renewal.

In its response dated August 30, 2006, the applicant stated that the backup diesel fuel transfer pump (P-181) and its hydro-turbine are in the diesel fire pump day tank room in the intake structure. The applicant clarified that the only components impacted by their failure are FP system components. LRA Section 2.3.3.9 states that the FP system has no 10 CFR 54.4(a)(1) intended functions; therefore, the applicant explained, because the failure of the backup diesel fuel transfer pump or its hydro-turbine cannot prevent satisfactory performance of any 10 CFR 54.4(a)(1) function neither is within the 10 CFR 54.4(a)(2) scope of license renewal.

The applicant's response to RAI 2.3.3.7-2 cited UFSAR Section 8.5.2, which states that the redundant pump allows extended operation of the diesel fire pump as a water source for the RHR system during extended SBO and severe accident scenarios beyond design basis. The applicant concluded that the backup diesel fuel transfer pump and hydro-turbine are not required for compliance with NRC FP regulations (10 CFR 50.48) and are not within the 10 CFR 54.4(a)(3) scope of license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-2 acceptable because it adequately explained that the backup diesel fuel transfer pump and its hydro-turbine are in the diesel fire pump day tank room in the intake structure, which contains no 10 CFR 54.4(a)(1) SSCs. In addition, they are not within the scope of license renewal for 10 CFR 54.4(a)(3) because they allow extended operation of the diesel fire pump during accidents beyond design basis and during extended SBO. Therefore, the staff's concern described in RAI 2.3.3.7-2 is resolved.

In RAI 2.3.3.7-3 dated July 31, 2006, the staff stated that a license renewal drawing note indicated a rain-tight lid under the manhole cover of the diesel fuel oil storage tanks T-160A and T-160B. LRA Tables 2.3.3-7 and 3.3.2-7 includes entries for component type "tank." The staff found no entry for the rain-tight lid in LRA Table 2.3.3-7; therefore, the staff asked the applicant to state whether the rain-tight lid is composed of a different material from that indicated for the component type "tank" and, if so, to state whether the lid is subject to an AMR or, if not, to justify its exclusion.

In its response dated August 30, 2006, the applicant stated that note 15 on license renewal drawing LRA-M-264-0 refers to the rain-tight lids under the manhole covers for the SBO diesel fuel oil storage tanks. The applicant explained that the manhole surrounds the fiberglass tank access port and, therefore, the manholes, manhole covers, and rain-tight lids are not parts of the tank pressure boundary and not subject to an AMR. The applicant further stated that the access ports are parts of the tanks and, therefore, included in the “tank” line items in LRA Tables 2.3.3-7 and 3.3.2-7.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-3 acceptable because it adequately explained that the manhole surrounds the fiberglass tank access port but is not part of the tank. The port, which is part of the tank, is included in the “tank” and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.7-3 is resolved.

In RAI 2.3.3.7-4 dated July 31, 2006, the staff stated that the ladders and check valves on license renewal drawings are not shown as subject to an AMR. Additionally, there are four-inch “FRP” lines not shown as subject to an AMR. The staff asked the applicant to state whether failure of these internal components could prevent the SBO diesel fuel oil storage tanks from performing their intended function.

In its response dated August 30, 2006, the applicant stated that the ladders, overfill prevention valves, and internal piping from the abandoned fill lines noted in RAI 2.3.3.7-4 are not subject to an AMR. The applicant explained that they form no part of the tank pressure boundary and their failure would not prevent the tanks from performing their intended function.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.7-4 acceptable because it explained that the equipment forms no part of the tank pressure boundary and so could not prevent the tanks from performing their intended function. Therefore, the staff's concern described in RAI 2.3.3.7-4 is resolved.

2.3.3.7.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the diesel fuel oil 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).

2.3.3.8 Compressed Air (Instrument Air)

2.3.3.8.1 Summary of Technical Information in the Application

LRA Section 2.3.3.8 describes the compressed air (instrument air) system (CAS), which provides a continuous supply of oil-free compressed air for instrumentation control, for various mixing, sluicing, scrubbing, and drying operations, and for operation of miscellaneous service equipment. The system consists of the high-pressure service air system, the instrument air system, and the low-pressure service air system. The high-pressure service air system supplies a common header with three reciprocating and three rotary screw-type air compressors arranged in parallel. The system delivers air to plant services (*e.g.*, air-powered tools) requiring no drying. The low-pressure service air system supplies oil-free air for mixing, agitating, and purging functions. The instrument air system is supplied from the common header through separate dryers and filters. The system provides dry, oil-free air to various systems for the operation of valves and instrumentation. In addition, the system extends the primary containment. The instrument air system has separate accumulators and tanks that store high-pressure air or nitrogen for operation of safety-related equipment (main steam safety valves, nuclear system pressure relief valves, torus vacuum breakers, SGTS dampers, and EDG dampers).

The CAS has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the CAS could prevent satisfactory performance of a safety-related function. Nonsafety-related portions with the potential to affect safety-related systems or components adversely (10 CFR 54.4(a)(2)) are reviewed with miscellaneous systems within the scope of license renewal in accordance with10 CFR 54.4(a)(2) (LRA Section 2.3.3.14). In addition, the CAS performs FP functions.

LRA Tables 2.3.3-8 and 2.3.3-14-2 show CAS component types within the scope of license renewal and subject to an AMR:

- bolting
- flex hose
- tank

- piping
- tubing
- valve body

The CAS component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.8.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.3.8 and 2.3.3.14, and UFSAR Section 10.11 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.8 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded the staff's RAIs as discussed below.

In RAI 2.3.3.8-1 dated July 31, 2006, the staff stated that LRA Section 2.3.3.8 refers to accumulators for the operation of "main steam safety valves" whereas the license renewal drawings show instrument air to "main steam isolation valves." Therefore, the staff asked the applicant to explain this apparent discrepancy.

In its response dated August 30, 2006, the applicant stated that the main steam safety valves noted in RAI 2.3.3.8-1 had been specified inadvertently instead of main steam isolation valves. The applicant stated that LRA Section 2.3.3.8 for the CAS had been revised to specify main steam isolation valves instead of main steam safety valves.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.8-1 acceptable because it adequately explained that LRA Section 2.3.3.8 inadvertently specified the main steam safety valves instead of main steam isolation valves. Further, the applicant properly corrected LRA Section 2.3.3.8 to change "main steam safety valves" to "main steam isolation valves." Therefore, the staff's concern described in RAI 2.3.3.8-1 is resolved.

In RAI 2.3.3.8-2 dated July 31, 2006, the staff stated that six valves in the CRD hydraulic system are shown on license renewal drawings with a system intended function. The staff noted that the associated instrument air components are not shown as subject to an AMR. Therefore, the staff asked the applicant to explain how these six valves alone perform a license renewal intended function and yet are not subject to an AMR.

In its response dated August 30, 2006, the applicant stated that the CRD air header pressure control valves PCV-302-89A/B/C noted in RAI 2.3.3.8-2 reduce instrument air pressure in the scram pilot valve air header for reduced control rod insertion times. Pressure boundary integrity is not required for these valves because the CRD components achieve their desired position on a loss of header air pressure. The applicant stated that, although these valves support a system intended function in accordance with 10 CFR 54.4, they perform that function with moving parts and a change in configuration. The applicant concluded that PCV-302-89A/B/C valve bodies have no pressure boundary component intended function and, therefore, do not require an AMR in accordance with 10 CFR 54.21(a).

The applicant also explained that the alternate rod insertion valves, SV-302-26A/B, and their air dump valves open exhaust ports to depressurize the scram valve pilot air header and initiate a scram to mitigate the consequences of an ATWS event. The applicant explained that pressure boundary integrity is not required for these valves because the CRD components achieve their desired position on a loss of header air pressure. Although these valves support a 10 CFR 54.4 system intended function, they perform that function with moving parts and a change in configuration. The valve bodies have no pressure boundary component intended function and, therefore, do not require an AMR in accordance with 10 CFR 54.21(a).

Based on its review, the staff finds the applicant's response to RAI 2.3.3.8-2 acceptable because it adequately explained that pressure boundary integrity is not required for valves PCV-302-89A/B/C and SV-302-26A/B because the CRD components achieve their desired position on a loss of header air pressure. The applicant further stated that, although these valves support a 10 CFR 54.4 system intended function, they perform that function with moving parts and a change in configuration. The valve bodies have no pressure boundary component intended function and, therefore, do not require an AMR in accordance with 10 CFR 54.21(a). Therefore, the staff's concern described in RAI 2.3.3.8-2 is resolved.

In RAI 2.3.3.8-3 dated July 31, 2006, the staff stated that an instrument air system line shown as within the scope of license renewal and subject to an AMR continues on a drawing which does not refer to the initial license renewal drawing. Therefore, the staff asked the applicant to clarify the instrument air system license renewal boundary interface between the two drawings.

In its response dated August 30, 2006, the applicant stated that the instrument air system line on license renewal drawing LRA-M-219 at location F-5 continues on license renewal drawing LRA-M-220-SH-02 at location E-8 as indicated on the drawing. In addition, this same line continues on LRA-M-67-96 at location D-2 although not specifically indicated on LRA-M-220-SH-02. Similarly, the instrument air system line on license renewal drawing LRA-M-219 at location C-7 continues on LRA-M-220-SH-02 at location E-2 and on LRA-M-67-96 at location D-2. The EDG dampers backup air supply components are shown on both LRA-M-220-SH-02 and LRA-M-67-96.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.8-3 acceptable because, although the drawing reference on LRA-M-67-96 at location D-2 is incorrect, the applicant explained the correct instrument air line routing. The applicant clarified that the drawing reference continuation flag on LRA-M-67-96 at location D-2 should refer to LRA-M-220-SH-02. Therefore, the staff's concern described in RAI 2.3.3.8-3 is resolved.

In RAI 2.3.3.8-4 dated July 31, 2006, the staff noted that FSAR Section 10.11 states:

> A 3" back-up air supply system was added to the instrument air system, tying into the permanent plant hardpipe connection from the outside of the turbine building where it is connected to a diesel driven oil-free air compressor. This back-up source of instrument air is used for station black-out conditions and/or to provide additional air for times when the system is not available due to maintenance.

Therefore, the staff requested that the applicant include or justify the exclusion of the 10 CFR 54.4(a)(3) intended function of supporting backup source of instrument air credited in SBO regulations (10 CFR 50.63). In addition, the staff requested from the applicant the number of the drawing of the SBO 3-inch back-up air supply system.

In its response dated August 30, 2006, the applicant stated that, as documented in the NRC SER for SBO, PNPS is an alternate AC plant with no detailed scoping analysis required. The equipment necessary for compliance with NRC SBO regulations are the alternate AC diesel generator and related electrical equipment. According to NRC guidance for SBO license renewal scoping, switchyard equipment needed to restore offsite power is also within the scope of license renewal. The applicant explained that mechanical systems other than the alternate AC diesel and its support systems are not within the scope of license renewal under NRC SBO regulations. The backup source of instrument air performs no function for compliance with NRC SBO regulations (10 CFR 50.63). The applicant stated that this backup source of instrument air is shown on drawing M-220, sheet 1, which is not a license renewal drawing because it does not depict components within the scope of license renewal and subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.8-4 acceptable because PNPS per 10 CFR 50.63(a)(2) and (c)(2) is an alternate AC plant with no detailed scoping analysis required. Further, the applicant explained that mechanical systems other than the alternate AC diesel and its support systems are not within the 10 CFR 54.4(a)(3) scope of license renewal. The backup source of instrument air performs no function for compliance with NRC SBO regulations (10 CFR 50.63). Therefore, the staff's concern described in RAI 2.3.3.8-4 is resolved.

2.3.3.8.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the CAS components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.9 Fire Protection – Water

2.3.3.9.1 Summary of Technical Information in the Application

LRA Section 2.3.3.9 describes the FP-water system consisting of a site water supply supplemented by a city water main. The water supply is delivered by either an electric motor-driven pump or a diesel engine-driven pump. A small jockey pump maintains a constant pressure on the water system. The pumps feed outdoor fire hydrants, interior hose stations, sprinkler systems, and deluge systems for the station and can be used for back-up supply to the screen-wash system.

The failure of nonsafety-related SSCs in the FP-water system could prevent satisfactory performance of a safety-related function. The FP-water system also performs FP functions.

LRA Tables 2.3.3-9 and 2.3.3-14-12 show FP-water system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- heat exchanger (bonnet)
- heat exchanger (shell)
- heat exchanger (tubes)
- hydrant
- nozzle
- orifice
- piping
- pump casing
- silencer
- strainer
- strainer housing
- tank
- tubing
- turbocharger
- valve body

The FP-water system component intended functions within the scope of license renewal include:

- flow control or spray pattern
- filtration
- heat transfer
- pressure boundary

2.3.3.9.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.3.9 and 2.3.3.14, and UFSAR Section 10.8 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff also reviewed the approved FP SER dated December 21, 1978, and supplemental SERs. The applicant's FP CLB refers directly to this report, which summarizes the FP program and commitments to 10 CFR 50.48 with the guidance of Appendix A to Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976," August 23, 1976.

The staff's review of LRA Section 2.3.3.9 identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.9-1 dated July 26, 2006, the staff stated that license renewal drawings LRA-M-218-SH-01-0, LRA-M-218-SH-06-0, and LRA-M-218-SH-08-0 show the sprinkler and water spray systems for the turbine lube oil storage and conditioning as out of scope (*i.e.*, not colored in orange). The staff requested that the applicant verify whether the turbine lube oil storage sprinkler system, conditioning room ceiling sprinkler system, and conditioning pre-action water spray system 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, if excluded from the scope of license renewal and not subject to an AMR, justify the exclusion.

In its response dated August 22, 2006, the applicant stated that the turbine lube oil reservoir pre-action sprinkler subsystem, turbine lube oil storage room and ceiling sprinkler subsystems, and turbine lube oil conditioning pre-action water spray subsystem do not mitigate fires in areas with equipment important to safe shutdown of the plant and are not credited with achieving safe shutdown in a fire. Therefore, these subsystems are not included in any AMR.

Based on its review, the staff is not able to find the applicant's response to RAI 2.3.3.9-1 acceptable. The staff did not agree with the justification for excluding turbine lube oil reservoir pre-action sprinkler subsystem, turbine lube oil storage room and ceiling sprinkler subsystems, and turbine lube oil conditioning pre-action water spray subsystem on the bases that these fire suppression systems are not required for achieving safe-shutdown in the event of a fire. The staff finds that the applicant's analysis of fire protection regulation does not completely capture the fire protection SSCs required for compliance with 10 CFR 50.48. The scope of SSCs required for compliance to 10 CFR 50.48 and General Design Criterion (GDC) 3, "Fire protection," in 10 CFR Part 50, Appendix A, goes beyond preserving the ability to maintain safe-shutdown in the event of a fire.

GDC 3, states in part; "Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety." Furthermore, the general requirements provided in GDC 3 to "minimize the adverse effects of fires on SSC's important to safety" are stated to provide a general level of protection which is afforded to all systems, not only where required to prevent a loss of safe-shutdown capability. 10 CFR 50.48(a) states, "Each operating nuclear power plant must have a fire protection plan that satisfies Criterion 3 of Appendix A of this part." The term "important to safety" encompasses a broader scope of equipment than safety-related and safe-shutdown equipment." Though there is a focus on the protection of safety-related equipment or safe-shutdown equipment, this does not imply that there is an exclusion of any equipment which protects nonsafety-related equipment. For example, in accordance with 10 CFR 50.48, some portions of suppression systems may be required in plant areas where a fire could result in the release of radioactive materials to the environment, even if no safety-related or safe-shutdown equipment is located in that particular fire area. In addition, the term "important to safety" encompasses commitments made by the licensee to satisfy BTP APCSB 9.5-1, Appendix A, by providing certain equipment for the fire protection program.

The staff reviewed commitments made by the applicant to satisfy BTP APCSB 9.5-1, Appendix A, (BECo. Letter # 77-23)[1], which discussed that the turbine lube oil storage and conditioning room are separated with three-hour fire barriers with Class A fire doors from areas containing safety-related equipment. The three-hour fire barriers would protect SSCs important to safety in the turbine building and satisfy the requirements of Appendix A to BTP APCSB 9.5-1. Therefore, the staff finds that the turbine lube oil storage and conditioning room sprinkler systems cannot affect equipment and components important to safety and the sprinkler systems for the turbine lube oil storage and conditioning room were correctly excluded from the scope of license renewal and not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.9-1 is resolved.

In RAI 2.3.3.9-2 dated July 26, 2006, the staff stated that license renewal drawing LRA-M-218-SH-02-0 shows the piping downstream of the city water supply as out of scope. With the city water an alternate supply for the fire water system, the staff requested that the applicant explain whether this line should be within the scope of license renewal and subject to an AMR or, if not, explain the basis.

In its response dated August 22, 2006, the applicant stated that the site fire water system takes suction from two 250,000-gallon water tanks devoted exclusively to FP. Although the city water serves as an alternate supply for the fire water system, this source is not necessary to meet 10 CFR 50.48. Furthermore, since the city water is outdoors and away from safety-related equipment, the city water supply to the FP system cannot affect safety-related equipment per 10 CFR 54.4(a)(2) by potential spatial interaction. Therefore, the city water supply to the fire water system is not within the scope of license renewal or subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.9-2 acceptable because the alternate supply from the city water system is not required for compliance with NRC FP regulations and the staff has confirmed that the city water supply is not credited in the licensing basis for the FP system. Therefore, the staff concludes that this alternate water supply is excluded correctly from the scope of license renewal and not subject to an AMR. The staff's concern described in RAI 2.3.3.9-2 is resolved.

In RAI 2.3.3.9-3 dated July 26, 2006, the staff stated that LRA Table 2.3.3-9 excludes several components shown in color (*i.e.*, in-scope) in license renewal drawing LRA-M-218-SH-01-0. For example, a reducer flange shown in zone C-4 of the drawing appears to restrict flow to a fire

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[1] Fire Protection System Review APCSB 9.5-1, Pilgrim Nuclear Station, Boston Edison Company, Boston, Massachusetts, March 9, 1977.

hose station. A blind flange is shown in zone F-6 in the reactor auxiliary bay. "Street box" housing is indicated in zone E-2. An unknown function or component is indicated by small trapezoid symbols shown mainly in headers upstream of hose stations in several buildings. An unknown function or component is indicated by a semi-circle symbol in zone F-4 located along a 2.5-inch line upstream of two hose stations in the reactor building. The staff requested that the applicant explain whether these should be included in Table 2.3.3-9 as passive components within the scope of license renewal and subject to an AMR or, if not, justify the exclusion.

In its response dated August 22, 2006, the applicant stated that the small trapezoidal symbols in the license renewal drawing are reducers, and the semi-circle in zone F-4 is a weld cap. The reducers and weld cap are passive components subject to an AMR and included in the "piping" line item in Table 2.3.3-9. If such components have unique tag numbers or a specific component has a function other than pressure boundary, then flow elements, orifices, and thermowells are shown as separate component types.

The "street box" housing in zone E-2 of LRA-M-218-SH-01-0 is around the extension rod operating the buried valve and performs no component intended function (defined in LRA Table 2.0-1) and therefore is not subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.9-3 acceptable. Although the applicant states that it considers the flanges and weld caps included in the "piping" line item, the description of the "piping" line item in LRA Section 2.0 does not list these components specifically. In similar licensing renewal reviews, components like the "piping" line item excluded from the list of those subject to an AMR and from the definition of a line item term often are modified to include for completeness components not previously named either in the component list or in the definition. However, this applicant's response committed to treat these components (*i.e.*, flanges and weld caps) as "piping" line items and explained that only components with intended functions other than "pressure boundary" are listed separately from the line item. Because the applicant committed to treat these components as included in the "piping" line item with only a pressure boundary intended function, the staff is assured adequately that these components will be considered appropriately during plant aging management activities.

The staff finds that the street box housing is not relied on for actuation or protection of its valve; therefore, the staff concludes that this housing is excluded correctly from the scope of license renewal and not subject to an AMR. The staff's concerns described in RAI 2.3.3.9-3 are resolved.

In RAI 2.3.3.9-4 dated July 26, 2006, the staff stated that LRA Table 2.3.3-9 excludes several types of FP water system components that appear in the SER and its supplements and/or the UFSAR and in the license renewal drawings colored in orange. These components are listed:

- hose station
- hose connections
- pipe fittings
- couplings

- threaded connections
- restricting orifices
- interface flanges
- chamber housing
- actuator housing (*e.g.*, weight releasing cabinet housing)

For each, the staff requested that the applicant determine whether the component should be included in LRA Table 2.3.3.9 or, if not, state the basis for exclusion.

In its response dated August 22, 2006, the applicant addressed each component as follows:

- hose station – because they support 10 CFR 54.4(a)(3) equipment, hose stations are included in the structural AMR and in the "fire hose reels" line item in LRA Table 2.4-6.
- hose connections – included in the LRA Table 2.3.3-9 "piping" line item.
- pipe fittings – included in the LRA Table 2.3.3-9 "piping" line item.
- couplings – couplings are pipe fittings included in the LRA Table 2.3.3-9 "piping" line item.
- threaded connections – threaded connections are pipe fittings included in the "piping" line item in LRA Table 2.3.3-9.
- restricting orifices – included in the LRA Table 2.3.3-9 "piping" line item.
- interface flanges – interface flanges are pipe fittings included in the LRA Table 2.3.3-9 "piping" line item.
- chamber housing – retard chamber housings in sprinkler subsystems are included in the LRA Table 2.3.3-9 "tank" line item.
- actuator housing (*e.g.*, weight releasing cabinet housing) – actuator housing is part of the active component "actuator" not subject to an AMR.

The applicant modified LRA Table 2.3.3.9 to include for completeness components not previously named either in the component list or in the definition. Based on its review, the staff finds the applicant's response to RAI 2.3.3.9-4 acceptable.

The staff finds that each of the following components was not included in the LRA line item descriptions. For example, for hose stations the LRA description of "hose reels" does not specifically refer to and apparently does not apply to the passive housing (*i.e.*, hose station) that makes the reel easily accessible. For hose connections and threaded connections, the LRA description of "piping" line items does not specifically list and apparently does not include "connections." Couplings and interface flanges also are not listed specifically as "piping" line items. Chamber housings are not listed specifically in the LRA description of "tank" line items. However, this applicant's response committed to treat these components as included in the specified line items and to explain that only components with intended functions other than "pressure boundary" are listed separately. Because the applicant committed to treat these components as included in the line items specified, the staff is adequately assured that these components will be considered appropriately during plant aging management activities.

Because pipe fittings and restricting orifices clearly are included in the LRA description of "piping" line items, the staff concludes that these components are included correctly within the scope of license renewal and subject to an AMR.

For the actuator housing, although in other licensing renewal reviews similar components are considered passive and, therefore, included within the scope of license renewal and subject to an AMR, the staff recognizes that the applicant's treatment of this component as active will result in more vigorous oversight of its condition and performance. Because the applicant has treated the actuator housing as part of an active component (*i.e.*, the actuator), the staff concludes that the component was excluded correctly from the scope of license renewal and is not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.9-4 is resolved.

In RAI 2.3.3.9-5 dated July 26, 2006, the staff stated that LRA Table 2.3.3-9 excludes gear boxes, gauge snubbers, and other component types. The staff requested that the applicant determine whether these and/or additional component types are within the scope of license renewal, subject to an AMR, and should be included in Table 2.3.3-9 and, if not, justify the exclusion.

In its response dated August 22, 2006, the applicant stated that gear boxes are active components not subject to an AMR. Gauge snubbers in the tubing to instruments are included in the "Tubing" line item in LRA Table 2.3.3-9.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.9-5 acceptable because it adequately explained the applicant's interpretation of the component characterization. For the gear boxes, the treatment is similar to that of the actuator housing in that similar components have been considered passive in other licensing renewal reviews and, therefore, included within the scope of license renewal and subject to an AMR. However, the staff recognizes that the applicant's treatment of this component as active will result in more vigorous oversight of its condition and performance. Because the applicant has treated the actuator housing as part of an active component (*i.e.*, the actuator), the staff concludes that the component was excluded correctly from the scope of license renewal and subject to an AMR.

For gauge snubbers, again this item is not listed specifically in the description of the "tubing" line item in the LRA; however, because the applicant has committed to treat these snubbers as included in the "tubing" line item, the staff is adequately assured that this component will be considered appropriately during plant aging management activities. Therefore, the staff's concern described in RAI 2.3.3.9-5 is resolved.

In RAI 2.3.3.9-6 dated July 26, 2006, the staff stated that LRA Tables 2.4-2, 2.4-3, 2.4-4, and 2.4-6 exclude noncombustible shields and curbs (and scuppers) from the list of structural FP components within the scope of license renewal and subject to an AMR. SER Section 3.1.11 addresses the use of noncombustible shields between feedwater pumps to prevent impingement of oil released from one pump on the other pumps. SER Sections 3.1.11 and 4.8 address the use of curbs (and scuppers) in the diesel oil day tank rooms to contain potential oil spills and prevent them from spreading to other fire areas in an oil fire. The staff requested that the applicant determine whether noncombustible shields and curbs (and scuppers) should be included as components within the scope of license renewal and subject to an AMR.

In its response dated August 22, 2006, the applicant stated that the noncombustible shields between the feedwater pumps are subject to an AMR. The shields are composed of galvanized unistrut frames and marinate boards. The marinite is included in the "fire wrap" line item under elastomers and other materials in LRA Table 2.4-6. The frames are included in the "instrument racks, frames, and tubing trays" line item under steel and other metals in LRA Table 2.4-6. LRA Table 2.4-6 also lists steel and concrete flood curbs as components subject to an AMR including the curbs in the diesel oil day tank rooms. Scuppers are openings in the curbs rather than separate components.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.9-6 acceptable. Although the applicant states that it considers the noncombustible shields and curbs included in the line items, the descriptions of these line items in LRA Tables 2.4-2 thru 2.4-6 do not list these components specifically. "Flood curbs" are listed as a line item but not for an FP intended function (*i.e.*, preventing the spread of combustible liquids during a fire) as described in the SER. Noncombustible shields are not listed at all. In similar licensing renewal reviews, components excluded from the list of those subject to an AMR and excluded from the definition of a line item term often are modified for completeness to include components not previously named either in the component list or in the definition. However, the applicant committed to treat these components (*i.e.*, noncombustible shields and curbs) with the FP intended function as line items for "instrument racks, frames, and tubing trays," "fire wrap," and "flood curbs." Because the applicant committed to interpret these line items to include noncombustible shields and curbs intended for FP, the staff is adequately assured that these components will be considered appropriately as within the scope of licensing renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.9-6 is resolved.

In RAI 2.3.3.9-7 dated July 26, 2006, the staff stated that LRA Table 2.4-6 excludes smoke seals and fire retardant coatings from the list of structural bulk commodities components within the scope of license renewal and subject to an AMR. The SER supplement dated March 24, 1988, addresses the installation of smoke seals in electrical conduits that pass through fire barriers and between fire areas. SER Sections 3.2.4 and 4.11 address the use of fire retardant coatings to protect polyvinyl chloride-jacketed cables not installed in enclosed cable trays. The staff requested that the applicant determine whether these two components should be within the scope of license renewal and subject to an AMR or justify exclusion if out of scope.

In its response dated August 22, 2006, the applicant stated that smoke seals and fire retardant coatings are included in line items "fire stops" and "fire wraps" in LRA Table 2.4-6.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.9-7 acceptable. Although the applicant states that it considers smoke seals and fire retardant coatings included in the line items for "fire stops" and "fire wraps," the descriptions of these line items in LRA Table 2.4-6 do not list these components specifically. In similar licensing renewal reviews, components excluded from the list of components subject to an AMR and from the definition of a line item term often are modified for completeness to include components not previously named either in the component list or in the definition. However, this applicant's response committed to treat these components (*i.e.*, smoke seals and fire retardant coatings) as line items for "fire stops" and "fire wraps," respectively. Because the applicant committed to interpret these line items to include smoke seals and fire retardant coatings, the staff is adequately assured that these components will be considered appropriately as within the scope of licensing renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.9-7 is resolved.

In RAI 2.3.3.9-8 dated July 26, 2006, the staff stated that SER Section 4.3.5 addresses automatic water spray for the main power, auxiliary, and shutdown transformers. However, license renewal drawings LRA-M-218-SH-01-0 and LRA-M-218-SH-05-0 show the main transformer, auxiliary transformer, startup transformer, and shutdown transformer sprinkler systems as out of scope of license renewal. The staff requested that the applicant explain whether these transformer sprinkler systems should be within the scope of license renewal and subject to an AMR.

In its response dated August 22, 2006, the applicant stated that the FP system is within the scope of license renewal for 10 CFR 54.4(a)(3) because it is credited in the 10 CFR Part 50, Appendix R, safe-shutdown analysis (10 CFR 50.48). However, the main transformer sprinkler, auxiliary transformer sprinkler, startup transformer sprinkler, and shutdown transformer sprinkler subsystems do not mitigate fires in areas with equipment important to safe operation of the plant, nor are they credited with achieving safe shutdown in a fire. Therefore, these subsystems are not included in the AMR summarized in LRA Table 3.3.2-9.

In addition, the main transformer sprinkler, auxiliary transformer sprinkler, startup transformer sprinkler, and shutdown transformer sprinkler subsystems are deluge systems that do not normally contain water. Therefore, these subsystems require no 10 CFR 54.4(a)(2) AMR for potential spatial interaction.

In evaluating this response, the staff found that it was incomplete and that review of LRA Section 2.3.3.9 could not be completed. Automatic water spray for the main transformer, auxiliary transformer, startup transformer, and shutdown transformer are excluded from scope of license renewal and not subject to an AMR. The staff finds this contrary to the original PNPS fire protection safety evaluation (SE) and UFSAR as the CLB. The applicant explained that the automatic water spray for the main transformer, auxiliary transformer, startup transformer, and shutdown transformer are not credited to meet the requirements of 10 CFR Part 50, Appendix R. In a telephone conference on December 12, 2006, the staff explained that the scope of SSCs required for compliance to 10 CFR 50.48, in 10 CFR Part 50, Appendix A, GDC 3, goes beyond preserving the ability to maintain safe-shutdown in the event of a fire. The staff stated that the exclusion of fire protection SSCs, on the basis that the intended function is not required for the protection of safe-shutdown equipment or safety-related equipment, is not acceptable if the SSC is required from compliance with 10 CFR 50.48.

In a letter dated January 16, 2007, the applicant stated that during the conference call on December 12, 2006, it was recognized by the NRC license renewal staff that the fire suppression system for the three transformers adjacent to the turbine building was addressed in the Appendix A to BTP APCSB 9.5-1 response (Boston Edison Company letter dated March 9, 1977) and related staff safety evaluation report dated December 21, 1978. Upon further consideration, automatic water spray systems to the main transformer, auxiliary transformer, and shutdown transformer are conservatively included within the scope of license renewal and subject to an AMR. Additionally, for new combinations of material, environment, aging effects and aging management programs (AMPs), the applicant added piping, nozzle and valve body line items to Table 3.3.2-9. Note that automatic water spray system for startup transformer was not discussed in applicant's January 16, 2007, response.

The staff reviewed the drawings contained in Section 1 response to Appendix A to BTP APCSB 9.5-1 (BECo. Letter # 77-23, March 9, 1977) to verify the location of the main transformer, auxiliary transformer, startup transformer, and shutdown transformer. Figures I-3 and I-5 of BECo. Letter # 77-23 show that the main transformer, auxiliary transformer, and shutdown transformer are approximately 26 feet distance from the turbine building boundary. The startup transformer is located in plant switchyard, approximately 200 feet away from turbine building and satisfy the Appendix A to BTP APCSB 9.5-1 requirements for spatial separation distance. Therefore, the staff finds a fire from the startup transformer cannot affect safety-related equipment and the automatic water spray system for the startup transformer correctly excluded from the scope of license renewal and not subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.9-8 acceptable because the applicant has committed to include three outdoor transformer fire suppression systems within the scope of license renewal and subject to an AMR. Therefore, the staff is adequately assured that the water spray systems for fire suppression of the main transformer, auxiliary transformer, and shutdown transformer will be considered appropriately during the aging management activities. Therefore, the staff's concern described is RAI 2.3.3.9-8 is resolved.

In RAI 2.3.3.9-9 dated July 26, 2006, the staff noted that SER Section 4.3.5 states that new sprinkler systems were proposed for the radwaste truck loading area and the access control area of the radwaste and control building. UFSAR Section 10.8.3.1 indicates sprinkler system FP for the access control area (*i.e.*, wet pipe) and the radwaste truck lock area (*i.e.*, dry pipe). However, the license renewal drawing LRA-M-218-SH-01-0 shows these areas as out of scope. The staff asked whether these systems are within the scope of license renewal and subject to an AMR.

In its response dated August 22, 2006, the applicant stated that although the sprinkler subsystem for the radwaste truck loading area does not mitigate fires in areas with equipment important to safe operation of the plant and is not credited with achieving safe shutdown in a fire, it could affect safety-related equipment that requires a CFR 54.4(a)(2) AMR for potential spatial interaction. Therefore, this subsystem is subject to an AMR and is addressed in LRA Table 3.3.2-14-12. Because this component is subject to an AMR solely for physical interaction under 10 CFR 54.4(a)(2), it is not highlighted on the license renewal drawings.

The sprinkler subsystem for the access control area of the radwaste and control building is necessary under 10 CFR 50.48, and should be designated FP-Q on the license renewal drawing, and is subject to an AMR. (A condition report has been issued under the corrective action program to correct the subsystem designation on the drawing.) License renewal drawing LRA-M-218-SH-01-0 should have shown this subsystem as subject to an AMR. As the components, materials, and environments for this subsystem are the same as those for other subsystems, no changes are required to LRA Tables 2.3.3-9 or 3.3.2-9.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.9-9 acceptable. The sprinkler system for the radwaste truck loading area, although not highlighted in the license renewal drawing, is within the scope of license renewal and subject to an AMR. Systems and components subject to an AMR solely for physical interaction under 10 CFR 54.4(a)(2) are not highlighted on the license renewal drawings.

The exclusion of the sprinkler system for the access control area of the radwaste and control building from the highlighted portion of license renewal drawing LRA-M-218-SH-01-0 was an inadvertent error. With the corrective actions described by the applicant's response to this finding, this subsystem will be shown correctly as within the scope of license renewal and subject to an AMR. Therefore, with the corrective actions described in the applicant's response for this subsystem, the staff's concern described in RAI 2.3.3.9-9 is resolved.

In RAI 2.3.3.9-10 dated July 26, 2006, the staff stated that SER Section 4.8 addresses floor drains in all plant areas protected with fixed water fire suppression. LRA Section 2.3.3.9 states that structural FP components are reviewed in the structural evaluation for their buildings or in the structural bulk commodities review. However, LRA Tables 2.4-2, 2.4-3, 2.4-4, and 2.4-6 do not list floor drains as FP components within the scope of license renewal or subject to an AMR. The staff asked that the applicant determine whether floor drains should be included within the scope of license renewal and subject to an AMR or, if not, to justify exclusion.

In its response dated August 22, 2006, the applicant stated that water-filled components in the radioactive waste system (which includes the floor drain system) that could affect safety-related equipment are subject to a 10 CFR 54.4(a)(2) AMR for potential spatial interaction and are addressed in LRA Table 3.3.2-14-23.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.9-10 acceptable. Although the SER addresses these floor drains as for fire suppression, they are not included in LRA Table 3.3.2-14-12, "Fire Protection System Nonsafety-Related Components Affecting Safety-Related Systems" but in LRA Table 3.3.2-14-23, "Radioactive Waste System," which is within the scope of license renewal and subject to an AMR. Because the applicant has committed to treat these floor drains as included in the radioactive waste system, which is within the scope of license renewal and subject to an AMR, the staff is adequately assured that the floor drains for fire suppression will be considered appropriately during plant aging management activities. Therefore, the staff's concern described in RAI 2.3.3.9-10 is resolved.

2.3.3.9.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the FP-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).

2.3.3.10 Fire Protection – Halon

2.3.3.10.1 Summary of Technical Information in the Application

LRA Section 2.3.3.10 describes the FP-Halon system, which provides adequate FP and ensures safe shutdown in a fire in plant areas requiring Halon systems for compliance with FP regulations. There are no safety-related components in the FP-Halon system; however, passive mechanical components in the cable spreading room are required for FP, the only system portion subject to these regulations.

LRA Table 2.3.3-10 shows FP-Halon system component types within the scope of license renewal and subject to an AMR:

- bolting
- flex hose
- nozzle
- piping
- tank
- valve body

The FP-Halon system component intended functions within the scope of license renewal include:

- flow control or spray pattern
- pressure boundary

2.3.3.10.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.10 and UFSAR Section 10.8 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff also reviewed the approved FP SER dated December 21, 1978, and supplemental SERs. The PNPS FP CLB refers directly to the 1978 report, which summarizes the FP program and 10 CFR 50.48 commitments using the guidance of Appendix A to Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants, Docketed Prior to July 1, 1976," August 23, 1976.

The staff's review of LRA Section 2.3.3.10 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.10-1 dated July 26, 2006, the staff noted that license renewal drawing LRA-M-218-SH-04-0 shows a manual pneumatic actuator colored in purple (*i.e.*, in-scope); however, the actuator housing is not listed in LRA Table 2.3.3-10. The staff asked the applicant to clarify whether actuator housings are within the scope of license renewal and subject to an AMR *or, if not, to justify the exclusion.*

In its response dated August 22, 2006, the applicant stated that the housings for the pneumatic actuators on license renewal drawing LRA-M-218-SH-04-0 are parts of the system pressure boundary and therefore subject to an AMR. As they are small components without unique tag numbers and no function other than pressure boundary, the housings for the pneumatic actuators are included in the "piping" line item in Table 2.3.3-10.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.10-1 acceptable. This issue is similar to those raised in SER Section 2.3.3.9. The staff finds that certain components not specifically listed in the LRA tables and line items are treated by the applicant as included in certain LRA line items regardless of whether they are specifically listed in the LRA description of that line item. In this case as with others addressed in the previous section, although the actuator housing is not listed in Table 2.3.3-10 and the description of the "piping" line item does not specifically list "housings," the applicant treats these housings as included in the "piping" line item. With the pressure boundary function only, these housings are not listed separately.

In similar licensing renewal reviews, components excluded from the list of those subject to an AMR and from the definition of a line item term as the "piping" line item, often are modified to include for completeness components not previously named either in the component list or in the definition. However, this applicant's response committed to treat these components as included in the "piping" line item and explained that only components with intended functions other than "pressure boundary" are listed separately. Therefore, because the applicant has committed to treat these actuator housings as included in the "piping" line item with the intended function as a "pressure boundary" only, the staff is adequately assured that the actuator housings will be considered appropriately during plant aging management activities and the staff's concern described in RAI 2.3.3.10-1 is resolved.

In RAI 2.3.3.10-2 dated July 26, 2006, the staff noted that FP SER Section 4.4 addresses carbon dioxide (CO_2) as a fixed fire suppression system for the cable spreading room (CSR), turbine building tank, and hose reels in the switchgear, reactor feed pump, and generator areas. FP SER supplements address conversion of the CO_2 fixed-suppression capability to a Halon fixed-suppression capability for the CSR and the switchgear area. The status of the other areas (*i.e.*, the turbine building tank and the hose reels in the reactor feed pump and generator areas) is unclear. Therefore, the staff asked the applicant to clarify whether there is fixed suppression for these other areas and, if so, to describe the type of suppression and explain whether it is within the scope of license renewal and why.

In its response dated August 22, 2006, the applicant addressed the use of CO_2 as fixed fire suppression for the three areas/components in question (*i.e.*, CSR, turbine building tank, and hose reels. As to the tank in the turbine building, the response was that FP SER Section 4.4 does not state that the "turbine building tank" has a fixed fire suppression system, but that the CO_2 for fire suppression is stored in a low-pressure bulk storage tank in the turbine building.

The applicant also addressed the use of hose reels for CO_2 fire suppression in the switchgear, reactor feed pump, and generator areas. The applicant stated that three fire hoses utilizing liquid CO_2 are in both the 23-foot and 37-foot switchgear rooms and turbine deck adjacent to the reactor feedwater pumps; however, these fixed CO_2 subsystems are required for insurance purposes, not for protection of safety-related systems. For the main turbine generator areas, fire water subsystems are for suppression. CO_2 was not indicated for fire suppression in these areas.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.10-2 acceptable. As to the use of CO_2 as fixed fire suppression for the CSR, the staff confirmed that, although CO_2 was proposed originally in the FP SER, conversion from CO_2 fixed fire suppression to Halon fixed fire suppression addressed in FP SER supplements in fact was implemented. Therefore, the staff concludes that a CO_2 fixed fire suppression system for the CSR was not omitted from the scope of license renewal because Halon is the only means of fire suppression relied on for fixed suppression in the CSR and correctly designated in the LRA.

As to the turbine building tank, the applicant correctly quotes the FP SER, which describes the tank as a low-pressure bulk storage tank in the turbine building storing CO_2 for fire suppression. The staff confirmed that, although addressed in the FP SER, this CO_2 supply is not relied on for compliance with 10 CFR 50.48. Therefore, the staff concludes that it is correctly excluded from the scope of license renewal and not subject to an AMR.

As to the use of hose reels for CO_2 fire suppression in the switchgear, reactor feed pump, and generator areas, the staff confirmed that CO_2 fire suppression is not used in the main turbine generator areas. Therefore, because the CO_2 fire suppression system used in the switchgear rooms and the reactor feed pump area is not relied on for protection of safety-related systems, the staff concludes that it is excluded correctly from the scope of license renewal and not subject to an AMR. Therefore, the staff's concerns described in RAI 2.3.3.10-2 are resolved.

In RAI 2.3.3.10-3 dated July 26, 2006, the staff noted that FP SER Section 4.4, dated December 21, 1978, states that a total flooding Halon extinguishing system will be installed for the computer and storage room, and UFSAR Section 10.8.3.2 addresses automatic Halon suppression for the plant computer room and operation and maintenance building record storage vault. However, the license renewal drawing LRA-M-218-SH-04-0 does not show the computer and storage room as within the scope of license renewal and subject to an AMR. Furthermore, LRA Section 2.3.3-10 states that only passive mechanical components in the CSR Halon system are required for compliance with 10 CFR 50.48. Therefore, the staff asked the applicant to clarify whether these other areas are protected with automatic Halon suppression.

In its response dated August 22, 2006, the applicant stated that the previously installed total flooding, automatically-actuated Halon fire suppression systems protect the plant computer room and the operation and maintenance building record storage vault. These subsystems do not mitigate fires in areas with equipment important to safe operation of the plant and are not credited with achieving safe shutdown in a fire. Therefore, these subsystems are not included in the AMR summarized in LRA Table 3.3.2-10.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.10-3 acceptable because the plant computer and storage room now have a function different from that at the time of the FP SER, and the area is no longer relied on for safe shutdown. Therefore, because these areas are not relied on for protection of safety-related systems, the staff concludes that they are excluded correctly from the scope of license renewal and not subject to an AMR. The staff's concern described in RAI 2.3.3.10-3 is resolved.

2.3.3.10.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the FP-Halon 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).

2.3.3.11 Heating, Ventilation, and Air Conditioning

2.3.3.11.1 Summary of Technical Information in the Application

LRA Section 2.3.3.11 describes the HVAC systems, which control the station air temperatures and the flow of airborne radioactive contaminants for operability of station equipment and accessibility and habitability of station buildings and compartments. The HVAC systems include numerous subsystems which together comprise plant HVAC equipment. The HVAC systems include:

- drywell coolers
- movement control center (MCC) cubicle atmosphere control
- station heating system
- reactor building HVAC
- turbine building
- radwaste building
- access control area air conditioning
- intake structure
- post-accident sampling system (PASS) mezzanine MCC rooms ventilation
- diesel generator building HVAC
- main control room environmental control system
- equipment area cooling system (EACS)
- SBO diesel building HVAC
- security diesel building

The drywell coolers are designed to maintain drywell atmosphere temperatures within an acceptable range during normal station operation using RBCCW as a heat sink. MCC cubicle atmosphere control provides cooling and ventilation to safety-related control centers B17, B18, and B20 at the 23-foot elevation of the reactor building. Reactor building HVAC are divided into three major ventilation zones. One zone encloses the spaces above the operating (refueling) floor, the second encloses the recirculation pump motor generator sets (system 24K) using RBCCW as its heat sink, and the third encloses the remainder of the reactor building. Turbine building HVAC supply filtered air to all areas of the turbine building. Radwaste building HVAC maintain required space temperatures, provide adequate ventilation to remove heat from operating equipment, and provide adequate supply and exhaust to maintain the direction of air flow from lesser to greater areas of potential radioactivity. Access control area air conditioning maintains ventilation and constant temperature and humidity in that area. Intake structure HVAC ventilate the six areas of the intake structure: condenser circulating water pumps, SSW pumps, fire pumps, chlorination system, and traveling screens. PASS mezzanine MCC rooms ventilation cools and ventilates electrical equipment rooms with MCCs B17A and B18A on the PASS mezzanine. Diesel generator building HVAC maintain building temperature when the diesels are idle and support operation of the EDG and auxiliaries systems upon diesel startup. The main control room environmental control system supplies HVAC for the control room, the CSR, and the computer room. The EACS maintains the local environment of the CSCS, RCIC, and CRD pumps at temperatures within their normal operating limits. The SBO diesel building and the security diesel building HVACs ventilate those buildings.

The HVAC system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the HVAC system could prevent satisfactory performance of a safety-related function. In addition, the HVAC system performs FP and SBO functions.

LRA Tables 2.3.3-11 and 2.3.3-14-15 identify HVAC system component types within the scope of license renewal and subject to an AMR:

- bolting
- damper housing
- duct
- duct flexible connection
- expansion joint
- fan housing
- filter housing
- heat exchanger housing
- heat exchanger (shell)
- heat exchanger (tubes)
- louver housing
- piping
- pump casing
- strainer housing
- tank
- tubing
- valve body

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

- heat transfer
- pressure boundary

2.3.3.11.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.3.11 and 2.3.3.14, drawings LRA-283, 286, 288, 289, and 292, and UFSAR Sections 5.2, 5.3, 8.4.5.2, 10.9.3, 10.17, 10.18 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

Areas of staff review included drywell coolers, MCC cubical atmosphere control, reactor building HVAC, turbine building HVAC, radwaste building HVAC, access control area air conditioning, intake structure HVAC, PASS mezzanine MCC rooms ventilation, diesel generator building HVAC, main control room environmental control system, equipment area cooling system, SBO diesel building HVAC, and the security diesel building HVAC.

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

2.3.3.11.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the HVAC 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).

2.3.3.12 Primary Containment Atmospheric Control

2.3.3.12.1 Summary of Technical Information in the Application

LRA Section 2.3.3.12 describes the PCAC system, which maintains an inert atmosphere in primary containment, controls combustible gas under accident conditions if necessary, and consists of fans, valves, nitrogen vaporizers, storage tanks, piping, ducts, and an oxygen analyzer. The PCAC system uses nitrogen supplied from a cryogenic storage tank for normal system operation to purge and inert the drywell and suppression chamber. Normal and emergency exhaust lines off both the drywell and torus permit release of contaminated gases to the SGTS. There are connections to an H_2/O_2 analyzer for drywell and torus atmosphere sampling post-accident. The PASS system obtains reactor coolant and containment atmosphere samples under post-accident conditions. The system has no safety functions except support of primary containment isolation and the RCPB. The PASS consists of components that obtain liquid samples (from reactor coolant or the suppression pool) or gas samples (from drywell or torus atmosphere).

The PCAC system and PASS have safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the PCAC system and PASS could prevent satisfactory performance of a safety-related function.

LRA Tables 2.3.3-12, 2.3.3-14-20, and 2.3.3-14-22 identify PCAC system and PASS component types within the scope of license renewal and subject to an AMR:

- bolting
- condensing pot
- heat exchanger (shell)
- piping
- tubing
- valve body

The PCAC system and PASS component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.12.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.3.12 and 2.3.3.14, and UFSAR Sections 5.2.3, 5.4, 10.11.3.1, 10.19 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

Based on its review, the staff finds that the applicant has identified PCAC portions that meet the scoping and screening requirements of 10 CFR 54.4 and has included them within the scope of license renewal in LRA Section 2.3.3.12. The applicant also has included in LRA Table 2.3.3-12 PCAC components subject to an AMR in accordance with 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff found no omissions.

2.3.3.12.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the PCAC system and PASS components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.13 Fuel Pool Cooling and Fuel Handling and Storage Systems

2.3.3.13.1 Summary of Technical Information in the Application

LRA Section 2.3.3.13 describes the fuel pool cooling (FPC) and cleanup system, which maintains fuel pool water clarity, minimizes the concentration of spent fuel fission and corrosion products in the fuel pool water, and controls fuel pool water temperature so operating personnel can perform necessary manual operations above the pool efficiently. The FPC system consists of two pumps, two heat exchangers, a filter, and a demineralizer to filter and cool the spent fuel storage pool during normal plant operation as well as the reactor basin and the dryer/separator pool during refueling outages. Lines penetrating the refueling cavity and dryer/separator floor are seismic Class 1 and isolated by safety-related valves to protect spent fuel pool inventory. Except for these lines and valves, which are FPC system components, equipment in the system is seismic Class 2. Lines that extend below a minimum level in the pool are equipped with siphon breakers to prevent pool drainage to unsafe levels. A safety-related source of makeup to the pool is by the RHR system and the suppression pool.

The FPC and fuel handling and storage systems have safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the FPC and fuel handling and storage system could prevent satisfactory performance of a safety-related function. Nonsafety-related components the failure of which could prevent satisfactory accomplishment of safety functions are reviewed in LRA Section 2.3.3.14.

LRA Tables 2.3.3-13 and 2.3.3-14-14 show FPC and fuel handling and storage system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- heat exchanger (shell)
- neutron absorber (boraflex)
- neutron absorber (boral)
- orifice
- piping (including sparger)
- pump casing
- tank
- thermowell
- tubing
- valve body

The FPC and fuel handling and storage systems component intended functions within the scope of license renewal include:

- neutron absorption
- pressure boundary

Note: The spent fuel pool, reactor basin, dryer/separator storage pool, new fuel storage vault and racks (including fuel racks, gates, and liner, reactor well refueling bulkhead and bellows seal), and the refueling platform are included in the structural evaluations for the reactor building (LRA Section 2.4.2)

The components required to satisfy the RBCCW pressure boundary function are reviewed with RBCCW (LRA Section 2.3.3.3).

2.3.3.13.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.3.13 and 2.3.3.14, and UFSAR Sections 10.2, 10.3, and 10.4 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.3.13 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.13-1 dated July 31, 2006, the staff stated that on the license renewal drawing for the FPC and fuel handling and storage systems the spectacle flange RO-1001-75 is installed to allow augmented fuel pool cooling. When placed in service, restricting orifice RO-1001-75 limits flow from the RHR system after a break in the FPC piping. The staff believed that RO-1001-75, when placed in service, meets 10 CFR 54.4 (a)(2) criteria for functional support to a safety-related system with a component intended function of flow control. Therefore, the staff asked the applicant to justify the exclusion of flow control as an intended function requiring aging management for the component type orifice.

In its response dated August 30, 2006, the applicant stated that this line shown on LRA-M-241, sheet 1, from the RHR system to the spent fuel pool is subject to an AMR due to its function as a source of spent fuel pool makeup. The applicant explained that this line makes up water for inventory lost to boiling when the normal spent fuel pool cooling system is out of service and that restriction orifice RO-1001-75 has no required function of flow control in this emergency makeup function. The applicant then stated that the RHR to spent fuel pool line has an alternate function of supporting the nonsafety-related fuel pool cooling system using the RHR pump to recirculate and cool the reactor basin (augmented fuel pool cooling). For augmented fuel pool cooling, this orifice with downstream butterfly valve 19-HO-166 limits the flow to the desired rate. The applicant added that FSAR Section 4.8.5.6 states that the response time to a break in this nonsafety-related piping is based on a maximum flow rate of 5000 gallons per minute which does not credit a reduction of flow by this restriction orifice. The applicant summarized that orifice RO-1001-75 is the stainless steel orifice shown in LRA Table 3.3.2-13 with the intended function of pressure boundary. Although the orifice has no license renewal intended function of flow control, the water chemistry control-BWR program would manage the effects of aging on the pressure boundary function through the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.13-1 acceptable because it adequately explained that the RHR to spent fuel pool line has an alternate function of supporting the nonsafety-related fuel pool cooling system using the RHR pump to recirculate and cool the reactor basin (augmented fuel pool cooling). The applicant further explained that there is no license renewal flow control intended function because the response time to a break in this nonsafety-related piping is based on a maximum flow rate which does not credit flow reduction by the restriction orifice, RO-1001-75. Therefore, the staff's concern described in RAI 2.3.3.13-1 is resolved.

In RAI 2.3.3.13-2 dated July 31, 2006, the staff stated that on the license renewal drawing for the FPC and fuel handling and storage systems the removable screens attached to lines 4"-HE-19 and 3"-HE-19 for the dryer and separator pool and fuel pool gate drains, respectively, are excluded from an AMR. However, the actual lines are highlighted to indicate that they are subject to an AMR. Therefore, the staff asked the applicant to clarify whether the entire screen assembly including the pressure-retaining portion is subject to an AMR or to justify its exclusion.

In its response August 30, 2006, the applicant stated that the rectangles shown on license renewal drawing LRA-M-231, sheet 1, represent continuations of the pool liner and concrete. The removable screens over the entrances to the pool only remove debris during normal draining operations and support no safety function. The screens have no pressure boundary intended function.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.13-2 acceptable because it adequately explained that pressure boundary integrity is not required because the removable screens only remove debris during normal draining operations and support no safety function. The applicant further explained that the removable screens have no pressure boundary component intended function and, therefore, do not require an AMR in accordance with 10 CFR 54.21(a). Therefore, the staff's concern described in RAI 2.3.3.13-2 is resolved.

2.3.3.13.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the FPC and fuel handling and storage systems components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.14 Miscellaneous Systems In-scope for 10 CFR 54.4(a)(2)

2.3.3.14.1 Summary of Technical Information in the Application

LRA Section 2.3.3.14 describes the miscellaneous systems within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). Such systems interact with safety-related systems in one of two ways, functional or physical. LRA Table 2.3.3.14-A shows systems within the scope of license renewal with potential for physical interaction with safety-related components. Of these systems, the applicant stated that the following are not described elsewhere in the LRA:

- circulating water
- condensate
- condensate demineralizers
- extraction steam
- feedwater
- feedwater heater drains and vents
- offgas and augmented offgas
- potable and sanitary water
- radioactive waste
- reactor water cleanup
- sampling
- sanitary soiled waste and vent, plumbing, and drains
- screen wash
- TBCCW

The remaining systems shown in LRA Table 2.3.3.14-A as within the scope of license renewal with potential for physical interaction with safety-related components are addressed elsewhere in other LRA sections listed here:

- 2.3.1 CRD
- 2.3.1 RCS
- 2.3.2.1 RHR
- 2.3.2.2 core spray
- 2.3.2.4 HPCI
- 2.3.2.5 RCIC
- 2.3.3.1 SLC
- 2.3.3.2 SSW
- 2.3.3.3 RBCCW
- 2.3.3.4 EDG
- 2.3.3.7 fuel oil storage and transfer
- 2.3.3.8 CAS
- 2.3.3.9 FP-water
- 2.3.3.11 HVAC
- 2.3.3.12 PASS
- 2.3.3.12 PCAC
- 2.3.3.13 FPC and demineralizer
- 2.3.4.1 condensate storage and transfer
- 2.3.4.2 main steam
- 2.3.4.3 turbine generator and auxiliaries
- 2.3.4.4 main condenser

2.3.3.14A Circulating Water

2.3.3.14A.1 Summary of Technical Information in the Application

The circulating water system (CWS) provides the main condenser with a continuous supply of cooling water for removing heat from the turbine exhaust and turbine bypass steam as well as from other incidental sources. Seawater from Cape Cod Bay passes through trash racks and then through traveling screens. A major portion of the flow is directed to the circulating water pumps, which deliver water to the main condenser. The discharge from the condenser and from the SSW system is returned via the discharge channel to Cape Cod Bay. The CWS consists of two circulating water pumps, piping, and valves.

The failure of nonsafety-related SSCs in the CWS could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-1 shows CWS component types within the scope of license renewal and subject to an AMR:

- bolting
- expansion joint
- heat exchanger (shell)
- piping

- pump casing
- sight glass
- strainer housing
- tank
- thermowell
- tubing
- valve body

The CWS component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14A.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Section 11.6 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14A.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the CWS components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.14B Condensate

2.3.3.14B.1 Summary of Technical Information in the Application

The condensate system provides a dependable supply of high-quality, pre-heated feedwater from the condenser hotwell to the reactor at the required flow rates under normal and transient conditions. The condensate pumps take the condensate from the condenser hotwells and pump it through the air ejector condensers, gland seal condenser, and condensate demineralizers. Demineralizer effluent flows in two parallel streams through low-pressure feedwater heaters (three per train) to the reactor feed pumps, which are the boundary between condensate and feedwater systems.

The failure of nonsafety-related SSCs in the condensate system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-3 shows condensate system component types within the scope of license renewal and subject to an AMR:

- bolting
- expansion joint
- heat exchanger (shell)
- orifice
- piping
- pump casing
- sight glass
- strainer housing
- tank
- thermowell
- tubing
- valve body

The condensate system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14B.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Sections 11.7 and 11.8 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14B.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the condensate 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).

2.3.3.14C Condensate Demineralizer

2.3.3.14C.1 Summary of Technical Information in the Application

The condensate demineralizer system (CDS) maintains the required purity of feedwater to the reactor. A full-flow, mixed-bed CDS assures the specified conditions and produces the best feedwater quality attainable. The CDS consists primarily of mixed-bed ion exchangers and supporting piping and valves, including components that transfer spent and new or regenerated resin. Originally, acid and caustic subsystems supported regeneration of the demineralizer resin now supported by external resin cleaning equipment and the primary components of the acid and caustic subsystems have been abandoned in place.

The failure of nonsafety-related SSCs in the CDS could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-4 shows CDS component types within the scope of license renewal and subject to an AMR:

- bolting
- orifice
- piping
- sight glass
- strainer housing
- tank
- tubing
- valve body

The CDS component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14C.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Section 11.7 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14C.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the CDS components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.14D Extraction Steam

2.3.3.14D.1 Summary of Technical Information in the Application

The extraction steam system provides steam to the feedwater heaters to increase main feedwater temperature prior to its entry into the reactor. The system consists primarily of moisture separators between the high-pressure and low-pressure turbines, piping and valves between the various stages of the high- and low-pressure turbines, and the feedwater heaters. The pre-heating process extracts steam from various high- and low-pressure turbine stages and heats the feedwater system through the cascading series of feedwater heaters.

The failure of nonsafety-related SSCs in the extraction steam system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-9 shows extraction steam system component types within the scope of license renewal and subject to an AMR:

- bolting
- expansion joint
- piping
- tubing
- valve body

The extraction steam system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14D.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14D.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the extraction steam system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.14E Feedwater

2.3.3.14E.1 Summary of Technical Information in the Application

The feedwater system, together with the condensate system, dependably supplies high-quality, pre-heated feedwater from the condenser hotwell to the reactor at the required flow rates under normal and transient conditions. Flow from the reactor feed pumps, which are the boundary between condensate and feedwater systems, passes through high-pressure feedwater heaters, control valves, and containment isolation valves before reaching the reactor. A portion of ASME Class 1 feedwater piping is a flow path for HPCI and RCIC.

The failure of nonsafety-related SSCs in the feedwater system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-10 shows feedwater system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- heat exchanger (shell)
- orifice
- piping
- strainer housing
- tank
- thermowell
- tubing
- valve body

The feedwater system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14E.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Sections 4.11, 5.2, and 11.8 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

10 CFR 54.21(a)(1).

2.3.3.14E.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the feedwater 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).

2.3.3.14F Feedwater Heater Drains and Vents

2.3.3.14F.1 Summary of Technical Information in the Application

The feedwater heater drains and vents system pre-heats the feedwater to the reactor pressure vessel during plant operating conditions. Feedwater is pre-heated through two parallel trains of feedwater heaters, each consisting of five heaters and one drain cooler. The feedwater heater drains are flow paths for the moisture separator drain tanks, the steam seal regulator unloading line, and the feedwater heater cascading drains. The shell sides of the feedwater heaters have vents to purge the shell of air and noncondensable gases.

The failure of nonsafety-related SSCs in the feedwater heater drains and vents system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-11 shows feedwater heater drains and vents system component types within the scope of license renewal and subject to an AMR:

- bolting
- orifice
- piping
- sight glass
- tank
- thermowell
- tubing
- valve body

The feedwater heater drains and vents system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14F.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Section 11 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14F.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the feedwater heater drains and vents 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).

2.3.3.14G Offgas and Augmented Offgas

2.3.3.14G.1 Summary of Technical Information in the Application

The offgas and augmented offgas (AOG) systems remove, process, and dispose of non-condensable gases from the condenser. Gases from the unit are routed to the main stack for dilution and elevated release to the atmosphere. The offgas system consists of a steam jet air ejector unit, a mechanical vacuum pump, the gland seal exhaust subsystem, offgas filters, piping, and valves. The steam jet air ejector unit removes air and non-condensable gases from the main condenser during power operations. A mechanical vacuum pump removes air during startup and shutdown. Exhaust gases are routed to the AOG and returned to the offgas filters for discharge through the main stack. The offgas system exhausts non-condensable gases from the turbine generator gland seal condenser through the gland seal holdup line to the stack. The holdup line is designed for approximately two minutes of holdup delay time for the radioactive gases before discharge to the main stack. The discharge of the mechanical vacuum pump is routed through the gland seal holdup line.

The failure of nonsafety-related SSCs in the offgas and AOG system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-19 shows offgas and AOG system component types within the scope of license renewal and subject to an AMR:

- bolting
- ejector
- heat exchanger (shell)
- orifice
- piping
- pump casing
- tank
- thermowell

- tubing
- valve body

The offgas and AOG system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14G.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Sections 9.4 and 11.4 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14G.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the offgas and AOG systems components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.14H Potable and Sanitary Water

2.3.3.14H.1 Summary of Technical Information in the Application

The potable and sanitary water system provides drinking water and sewage system water necessary for normal station operation. Potable water is taken from the Town of Plymouth water main and distributed throughout the station piping system at town water pressure.

The failure of nonsafety-related SSCs in the potable and sanitary water system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-21 shows potable and sanitary water system component types within the scope of license renewal and subject to an AMR:

- bolting
- orifice
- piping
- pump casing
- strainer housing

- tubing
- valve body

The potable and sanitary water system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14H.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Section 10.12 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14H.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the potable and sanitary 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).

2.3.3.14I Radioactive Waste

2.3.3.14I.1 Summary of Technical Information in the Application

The radioactive waste system controls and safely collects, treats, and disposes of radioactive and potentially radioactive wastes so operation and availability of the station are not limited. The various subsystems of the radioactive waste system manage liquid and solid radwaste. Gaseous radwaste is addressed in the offgas and AOG systems evaluation.

The failure of nonsafety-related SSCs in the radioactive waste system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-23 shows radioactive waste system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- flex joint
- orifice

- piping
- pump casing
- sight glass
- tank
- tubing
- valve body

The radioactive waste system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14I.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Sections 9.2, 9.3, 10.7.6 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14H.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the radioactive waste 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).

2.3.3.14J Reactor Water Cleanup

2.3.3.14J.1 Summary of Technical Information in the Application

The reactor water cleanup (RWCU) system maintains reactor water purity within specified limits during all modes of reactor operation by removing soluble and insoluble impurities. The RWCU system reduces the secondary source of beta and gamma radiation from corrosion and fission products in the reactor primary system.

The failure of nonsafety-related SSCs in the RWCU system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-27 shows RWCU system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- heat exchanger (shell)
- orifice
- piping
- pump casing
- strainer housing
- tank
- thermowell
- tubing
- valve body

The RWCU system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14J.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Section 4.9 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14J.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the RWCU 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).

2.3.3.14K Sampling

2.3.3.14K.1 Summary of Technical Information in the Application

The process sampling system monitors the operational performance of station equipment. Sampling systems are designed (1) to obtain representative samples in forms which can be used in radio-chemical laboratory analysis for determination of station equipment effectiveness and (2) to minimize the radiation effects at the sampling stations.

The failure of nonsafety-related SSCs in the sampling system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-30 shows sampling system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- heat exchanger (coil)
- piping
- pump casing
- sight glass
- tank
- thermowell
- tubing
- valve body

The sampling system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14K.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Sections 4.10.3.3, 10.14, and 10.20 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14K.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the sampling 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).

2.3.3.14L Sanitary Solid Waste and Vent, Plumbing, and Drains

2.3.3.14L.1 Summary of Technical Information in the Application

The sanitary soiled waste and vent system collects and processes sanitary waste generated at the station. The system consists of three sewage lift stations, one sewage ejection pump in the turbine building, one package waste water treatment plant, and one sludge dewatering facility as well as piping and valves. The system purpose is to provide plumbing and drainage. The system includes roof and sanitary plumbing and drains. Station floor drains and sumps are included in the radwaste system.

The failure of nonsafety-related SSCs in the sanitary soiled waste and vent, plumbing, and drains system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-31 shows sanitary soiled waste and vent, plumbing, and drains system component types within the scope of license renewal and subject to an AMR:

- bolting
- piping
- pump casing
- tubing
- valve body

The sanitary soiled waste and vent, plumbing, and drains system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14L.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14L.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the sanitary soiled waste and vent, plumbing, and drains 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).

2.3.3.14M Screen Wash

2.3.3.14M.1 Summary of Technical Information in the Application

The screen wash system removes debris from the sea water supplied to the circulating water and SSW pumps. The screen wash system consists of two subsystems, the traveling screens and the screen wash trains. The screen wash subsystem consists of two screen wash pumps connected to a common discharge header from which four spray header lines branch off to the individual traveling screens. Suction for these screen wash pumps is by the SSW pumps. The traveling screens are cleaned by the screen wash subsystem.

The failure of nonsafety-related SSCs in the screen wash system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-32 shows screen wash system component types within the scope of license renewal and subject to an AMR:

- bolting
- orifice
- piping
- pump casing
- strainer housing
- tubing
- valve body

The screen wash system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14M.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, and UFSAR Section 11.6 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14M.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the screen wash components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.14N Turbine Building Closed Cooling Water

2.3.3.14N.1 Summary of Technical Information in the Application

The TBCCW system, which cools equipment in the turbine building and station air conditioning systems, consists of a single closed loop with two pumps taking suction from two heat exchangers which transfer heat to the SSW system. The TBCCW system provides an intermediate loop barrier which cools while isolating components from seawater in the SSW system.

The failure of nonsafety-related SSCs in the TBCCW system could prevent satisfactory performance of a safety-related function.

LRA Table 2.3.3-14-34 shows TBCCW system component types within the scope of license renewal and subject to an AMR:

- bolting
- compressor housing
- filter housing
- flex joint
- heat exchanger (shell)
- orifice
- piping
- pump casing
- strainer housing
- tank
- thermowell
- tubing
- valve body

The TBCCW system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.3.14N.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14 and UFSAR Section 10.6 using the evaluation methodology described in SER Section 2.3. The staff conducted its review in accordance with the guidance described in SRP-LR Section 2.3.

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

2.3.3.14N.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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the TBCCW 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).

2.3.4 Steam and Power Conversion Systems

LRA Section 2.3.4 describes 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 condensate storage system
- 2.3.4.2 main steam
- 2.3.4.3 turbine-generator and auxiliaries
- 2.3.4.4 main condenser

The staff's findings on review of LRA Sections 2.3.4.1 - 2.3.4.4 are in SER Sections 2.3.4.1 - 2.3.4.4, respectively.

2.3.4.1 Condensate Storage System

2.3.4.1.1 Summary of Technical Information in the Application

LRA Section 2.3.4.1 describes the condensate storage system, which provides for station makeup needs and accepts condensate system reject surges. Condensate storage tanks supply plant water needs for normal power generation. The condensate storage and transfer system consists of two condensate transfer pumps, two condensate storage tanks, a jockey pump, piping, and valves. The demineralized water system consists of a demineralized water storage tank, two pump trains, piping, and valves.

The condensate storage system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the condensate storage system could prevent satisfactory performance of a safety-related function. Nonsafety-related portions with the potential to affect safety-related systems or components adversely (10 CFR 54.4(a)(2)) are reviewed with miscellaneous systems within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) (LRA Section 2.3.3.14). In addition, the condensate storage system performs FP functions.

LRA Tables 2.3.4-1 and 2.3.3-14-5 show condensate storage system component types within the scope of license renewal and subject to an AMR:

- bolting
- filter housing
- orifice
- piping
- pump casing
- sight glass
- strainer housing
- tank
- thermowell
- tubing
- valve body

The condensate storage system component intended function within the scope of license renewal is to provide a pressure boundary.

2.3.4.1.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.4.1 and 2.3.3.14, and UFSAR Sections 10.3, 10.10, 11.9 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.4.1.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the condensate storage 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).

2.3.4.2 Main Steam

2.3.4.2.1 Summary of Technical Information in the Application

LRA Section 2.3.4.2 describes the main steam system, which conducts steam from the reactor vessel through the primary containment to the steam turbine. The main steam system includes the main steam lines, the main steam line flow restrictors, the main steam line isolation valves, the SRVs, safety valves of the nuclear system pressure relief subsystem, and components from the reactor vessel up to but not including the turbine stop valves. Portions of the main steam system form part of the RCPB and also extend the primary containment. The SRVs and safety valves of the nuclear system pressure relief subsystem prevent over-pressurization of the nuclear system. After a main steam line rupture outside the primary containment, the main steam line flow restrictors limit the loss of water from the reactor vessel before main steam line isolation valve closure. The main steam line isolation valves close automatically upon certain isolation signals to prevent damage to the fuel cladding by limiting the loss of reactor cooling water in a major leak from the steam piping outside the primary containment. Noble gas holdup and fission product plate-out in MSIV leakage are provided by main steam piping downstream of the MSIVs to the turbine stop valves, piping, and components in the turbine bypass lines and piping and components in the drain lines from the main steam lines to the condenser.

The main steam system has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the main steam system could prevent satisfactory performance of a safety-related function. In addition, the main steam system performs FP functions.

The ASME Class 1 portions of the MS system, including the safety valves, SRVs, flow restrictors and main steam isolation valves, are reviewed with the reactor coolant system (LRA Section 2.3.1.3). Components downstream of the SRVs, including the vacuum breakers on the discharge lines, are reviewed with the automatic depressurization system (LRA Section 2.3.2.3). Nonsafety-related portions with the potential to affect safety-related systems or components adversely (10 CFR 54.4(a)(2)) are reviewed with miscellaneous systems within the scope of license renewal for 10 CFR 54.4(a)(2) (LRA Section 2.3.3.14).

LRA Tables 2.3.4-2 and 2.3.3-14-18 show main steam system component types within the scope of license renewal and subject to an AMR:

- bolting
- condenser
- condenser (tubes)
- expansion joint
- orifice
- piping
- steam trap
- strainer housing
- thermowell
- tubing
- turbine casing
- valve body

The main steam system component intended functions within the scope of license renewal include:

- pressure boundary
- holdup and plateout of fission products

2.3.4.2.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.4.2 and 2.3.3.14, and UFSAR Sections 4.4, 4.5, 4.6, and 4.11 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.4.2.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the main steam 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).

2.3.4.3 Turbine-Generator and Auxiliaries

2.3.4.3.1 Summary of Technical Information in the Application

LRA Section 2.3.4.3 describes the turbine-generator and auxiliaries system, which converts a portion of the thermal energy in the steam from the reactor to electric energy and extracts steam and moisture for feedwater heating. The turbine-generator system includes the turbine, generator, exciter, controls, and additional auxiliary systems:

- turbine bypass system
- turbine sealing system
- turbine lube oil
- hydrogen seal oil system
- generator gas control system
- stator cooling water system
- isolated phase bus cooling system

The failure of nonsafety-related SSCs in the turbine-generator and auxiliaries system could prevent satisfactory performance of a safety-related function. Nonsafety-related portions with the potential to affect safety-related systems or components adversely (10 CFR 54.4(a)(2)) are reviewed with miscellaneous systems within the scope of license renewal for 10 CFR 54.4(a)(2) (LRA Section 2.3.3.14).

LRA Tables 2.3.4-2 and 2.3.3-14-35 show turbine-generator and auxiliaries system component types within the scope of license renewal and subject to an AMR:

- bolting
- condenser
- condenser (tubes)
- expansion joint
- filter housing
- heat exchanger (shell)
- heater housing
- orifice
- piping
- pump casing
- sight glass
- strainer housing
- tank
- thermowell
- tubing
- valve body

The turbine-generator and auxiliaries system component intended functions within the scope of license renewal include:

- pressure boundary
- holdup and plateout of fission products

2.3.4.3.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.4.3 and 2.3.3.14, and UFSAR Sections 11.2, 11.4.3.2, and 11.5 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

2.3.4.3.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the turbine-generator and auxiliaries 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).

2.3.4.4 Main Condenser

2.3.4.4.1 Summary of Technical Information in the Application

LRA Section 2.3.4.4 describes the main condenser system, which provides a heat sink for turbine exhaust steam, turbine bypass steam, heater drains, air ejector intercondenser drain, suction vents and other flows. It also provides deaeration and storage capacity for the condensate reused after a period of radioactive decay. Main condenser vents and drains are flow paths for drains from various systems back to the condenser. The main condenser is a twin-shell, horizontal-tube, seawater-cooled unit. For a two-minute decay period of the condensed steam, the condenser hotwells are equipped with baffling arranged to form labyrinths.

The failure of nonsafety-related SSCs in the main condenser system could prevent satisfactory performance of a safety-related function. Nonsafety-related portions with the potential to affect safety-related systems or components adversely (10 CFR 54.4(a)(2)) are reviewed with miscellaneous systems within the scope of license renewal for 10 CFR 54.4(a)(2) (LRA Section 2.3.3.14).

LRA Tables 2.3.4-2 and 2.3.3-14-17 show main condenser system component types within the scope of license renewal and subject to an AMR:

- bolting
- condenser
- condenser (tubes)
- expansion joint
- orifice
- piping
- steam trap
- strainer housing
- tank
- thermowell
- tubing
- valve body

The main condenser system component intended functions within the scope of license renewal include:

- pressure boundary
- holdup and plateout of fission products

2.3.4.4.2 Staff Evaluation

The staff reviewed LRA Sections 2.3.4.4 and 2.3.3.14, and UFSAR Sections 11.3, 11.4, and 14.5.1.3 using the evaluation methodology in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review of LRA Section 2.3.4.4 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 on the specific issues to determine whether the applicant had applied the 10 CFR 54.4(a) scoping criteria and the 10 CFR 54.21(a)(1) screening criteria properly. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.4.4-1 dated July 31, 2006, the staff noted, in UFSAR Section 11.3.3, a sight glass level indicator on the outlet of each water box for the main condenser. The staff questioned why the sight glass level indicator and its tubing were not included in LRA Table 2.3.4-2 as they provide the intended function of pressure boundary integrity for the main condenser and asked the applicant to justify the exclusion from LRA Table 2.3.4-2.

In its response dated August 30, 2006, the applicant stated that the sight glass level indicator and tubing noted in RAI 2.3.4.4-1 do not support the intended function of pressure boundary for the main condenser. The applicant further explained that the sight glass level indicators and tubing are on the water boxes as parts of the circulating water system, which is within the scope of license renewal in accordance with 10 CFR 54.4(a)(2), and that the sight glass indicators and tubing are shown with other circulating water system components on Tables 2.3.3-14-1 and 3.3.2-14-1.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.4-1 acceptable because it explained that the site glass level indicators and tubing are parts of the circulating water system and are within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) under that system rather than the main condenser system. Therefore, the staff's concern described in RAI 2.3.4.4-1 is resolved.

In RAI 2.3.4.4-2 dated July 31, 2006, the staff noted highlighted license renewal boundaries ending at normally open valves on license renewal drawings LRA-M-203-SH 1 and LRA-M-226-SH 1. The staff asked the applicant to justify ending the boundary highlighting or to describe the license renewal boundary on drawings for components downstream within the scope of license renewal.

In its response dated August 30, 2006, the applicant stated that, when required during an MSIV leakage event, valve 1-HO-107 on license renewal drawing LRA-M-203-SH-01-0 at location C-5 and downstream valve MO-S-1 on license renewal drawing LRA-M-226-SH-01-0 at location F-8 are closed to direct MSIV leakage flow to the condenser. The applicant stated that components downstream of these valves are not parts of the MSIV leakage pathway and are not subject to a 10 CFR 54.4(a)(1) AMR. The applicant further explained that components downstream of valve MO-S-1 are parts of the steam sealing system, a subpart of the turbine-generators and auxiliaries system. As described in LRA Section 2.3.4.3 and Table 2.3.3.14-35, these components are within the scope of license renewal in accordance with 10 CFR 54.4 (a)(2). Components downstream of valve 1-HO-107 are parts of the offgas and AOG systems. As described in LRA Section 2.3.3.14 and Table 2.3.3.14-19, these components are within the scope of license renewal in accordance with 10 CFR 54.4 (a)(2). The applicant referred to LRA Section 2.1.2.1.3, which states that license renewal drawings indicate by highlighting system portions that support system intended functions within the scope of license renewal with the exception of systems or system portions in-scope for 10CFR54.4(a)(2) for physical interaction.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.4-2 acceptable because it adequately explained that the components downstream of valves 1-HO-107 and MO-S-1 are within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) and subject to an AMR as part of the offgas and turbine-generators and auxiliaries systems, respectively. Therefore, the staff's concern described in RAI 2.3.4.4-2 is resolved.

In RAI 2.3.4.4-3 dated July 31, 2006, the staff noted that LRA Section 2.0 states that components with unique tag numbers or specific components with intended functions other than pressure boundary (e.g., flow elements, orifices, and thermowells) are shown as separate component types in its LRA Section 2.3 table. However, LRA Table 2.3.4-2 shows orifice RO-3058 as a component type with an intended function of pressure boundary but lists no other intended function, like flow control, for restricting orifices. The staff asked the applicant to justify the exclusion of the flow control intended function from LRA Table 2.3.4-2.

In its response dated August 30, 2006, the applicant stated that the components in the MSIV leakage pathway to the condenser have a pressure boundary function only because they provide the path for the leakage to the condenser. The applicant further explained that orifices in the pathway have no flow control intended function for license renewal as flow regulation in this line is not required to control that dose from MSIV leakage during accident conditions.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.4-3 acceptable because it adequately explained that restricting orifice RO-3058 does not control flow as an intended function. Therefore, the staff's concern described in RAI 2.3.4.4-3 is resolved.

2.3.4.4.3 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 components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes with reasonable assurance that the applicant has adequately identified the main condenser 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).

2.4 <u>Scoping and Screening Results: Structures</u>

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

- primary containment
- reactor building
- intake structure

- process facilities
- yard structures
- bulk commodities

Under 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 structures and components that meet the scoping criteria and are subject to an AMR.

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

Scoping. In its scoping evaluation, the staff reviewed the applicable LRA sections and component drawings, focusing on components that have not been identified as within the scope of license renewal. The staff reviewed relevant licensing basis documents, including the UFSAR, for each structure to determine whether the applicant has omitted from the scope of license renewal components with intended functions delineated under 10 CFR 54.4(a). The staff also reviewed the licensing basis documents to determine whether the LRA specified all intended functions delineated under 10 CFR 54.4(a). The staff requested additional information to resolve any omissions or discrepancies identified.

Screening. 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) are subject to replacement based on a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff sought to confirm that these SCs were subject to an AMR, as required by 10 CFR 54.21(a)(1). The staff requested additional information to resolve any omissions or discrepancies identified.

2.4.1 Primary Containment

2.4.1.1 Summary of Technical Information in the Application

LRA Section 2.4.1 describes the primary containment, which limits the release of fission products in postulated DBAs so offsite doses do not exceed 10 CFR Part 100 values. The primary containment inside the reactor building is a General Electric Mark I consisting of a drywell, a torus, and a connecting vent system. When operating at power, the containment is flooded with nitrogen to preclude the availability of oxygen. The drywell surrounds the reactor vessel and primary systems. The torus, a toroidal structure containing water, is below the drywell. The vent system connecting the drywell to the torus terminates below the water surface. Access is by the steel drywell head and its personnel hatch as well as by a double-door air lock, an equipment hatch, and one CRD access hatch. Concrete floor slabs, structural steel floors, and platforms inside the drywell are provided as required. The major structural components of the primary containment are the drywell, the torus, the reactor vessel and drywell bellows, and the sacrificial shield wall. The drywell is a carbon steel structure enclosed in reinforced concrete founded on bedrock. The torus is a toroidal-shaped carbon steel pressure vessel below and encircling the drywell. The reactor vessel refueling bulkhead assembly has two bellows constructed of stainless steel with backing plates, spring seals, and removable guard rings. The sacrificial shield wall is a high-density, steel-reinforced, concrete cylindrical structure surrounding the vessel.

Primary containment safety-related components are relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the primary containment could prevent satisfactory performance of a safety-related function. In addition, the primary containment performs FP functions.

LRA Table 2.4-1 shows primary containment component types within the scope of license renewal and subject to an AMR:

- steel and other metals
- concrete
- elastomers and other materials
- fluoropolymers and lubrite® sliding supports

LRA Table 2.4-1 shows the following primary containment component types within the scope of license renewal and subject to an AMR:

Steel and Other Metals

- bellows (reactor vessel and drywell)
- CRD removal hatch
- drywell head
- drywell shell
- drywell sump screen
- drywell to torus vent line bellows
- drywell to torus vent system
- equipment hatch
- jet deflectors
- personnel airlock
- primary containment electrical penetrations
- primary containment mechanical penetrations (includes those w/bellows)
- reactor vessel support assembly
- reactor vessel stabilizer supports
- sacrificial shield wall lateral supports
- sacrificial shield wall (steel portion)
- structural steel: plates, columns and beams
- torus electrical penetrations
- torus external supports (columns, saddles)
- torus manway
- torus mechanical penetrations
- torus ring girders
- torus shell

- torus thermowells
- vent header support

Concrete

- drywell sump
- equipment hatch concrete plug
- floor slabs, walls
- floor slabs, walls (EQ Zone 1.30, Drywell El. 9'-2")
- foundation
- reactor vessel support pedestal
- sacrificial shield wall (concrete portion)

Elastomer and Other Materials

- primary containment electrical penetration seals and sealant

Fluoro-polymers and Lubrite® Sliding Supports

- Lubrite® sliding supports

The intended functions of the primary containment components within the scope of license renewal include:

- shelter or protection for safety-related equipment, including radiation shielding and pipe whip restraint
- protective barrier for flood events
- heat sink during SBO or DBA
- missile barrier
- pressure boundary
- structural or functional support for safety-related equipment

2.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.4.1 and UFSAR Sections 5.1.2 and 5.2.3 using the evaluation methodology in SER Section 2.4 and the guidance in SRP-LR Section 2.4, "Scoping and Screening Results: Structures."

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

The staff's review of LRA Section 2.4.1 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant's response to the staff's RAIs and the staff's evaluation are discussed below.

In RAI 2.4.1-1 dated August 22, 2006, the staff stated that LRA Table 2.4-1 does not include drywell head closure bolts, backing plates, spring seals, and removable guard rings within the scope of license renewal though their intended functions are pressure boundary and support for 10 CFR 54.4(a)(1) equipment. The staff asked the applicant to justify not including them within the scope of license renewal.

In its response by letter dated September 13, 2006, the applicant stated that the drywell head closure bolts are included in item ASME Classes 1, 2, 3, and MC support bolting in LRA Table 2.4-6. Backing plates, spring seals, and removable guard rings along with refueling bellows are parts of the refueling cavity seal. The applicant also stated that the refueling cavity seal components perform no license renewal intended function and are not subject to an AMR as stated in the response to RAI 2.4.1-2.

Based on its review, the staff finds the applicant's response to RAI 2.4.1-1 acceptable because drywell head closure bolts are included in the LRA. The staff also finds the applicant's response for backing plates, spring seals, and removable guard ring acceptable based on the applicant's response to RAI 2.4.1-2. Therefore, the staff's concern described in RAI 2.4.1-1 is resolved.

In RAI 2.4.1-2 dated August 22, 2006, the staff stated that neither LRA Table 2.4-1 nor LRA Table 2.4-2 shows refueling cavity seal components within the scope of license renewal. The proposed license renewal interim staff guidance (LR-ISG) 2006-01, "Plant-Specific Aging Management Program for Inaccessible Areas of Boiling Water Reactor Mark 1 Steel Containment Drywell Shell," published in the Federal Register on May 9, 2006, states that the most likely cause of corrosion of the drywell shell in the sand-pocket areas (near the bottom of the drywell) and in the spherical portion of the drywell at higher elevations is the water in the gap between the drywell and the concrete shield, and noted the source of the water as leakage through the seal between the drywell and the refueling cavity. Therefore, the staff asked the applicant to include all refueling cavity seal components within the scope of license renewal on a drawing of them.

In its response dated September 13, 2006, the applicant stated that the proposed license renewal interim staff guidance LR-ISG-2006-01 states that, if moisture is detected or suspected in the inaccessible area on the exterior of the drywell shell, any component source of moisture (*e.g.*, refueling seal) should be included within the scope of license renewal and subject to an AMR.

In a letter dated January 29, 2007, the applicant stated that there has been no observed leakage causing moisture in the vicinity of the sand cushion at PNPS, and no moisture has been detected or suspected in the inaccessible areas of the drywell shell. Therefore, consistent with the draft ISG, the refueling seal is not subject to an AMR. In response to staff questions during the site audit, the applicant confirmed that refueling cavity seal components perform no license renewal intended function and are not subject to an AMR.

According to the letter dated January 29, 2007, the applicant continuously monitors the four annulus air gap drains twice every refuel outage, once after flood-up and again prior to flood-down at the end of the outage. Leakage never has been detected from the annulus air gap drains at PNPS. In 1987, access holes were machined in the drain line elbows on all four drain lines for access for remote visual examination with fiberscopes. No signs of obstruction or of corrosion on visible portions of the drywell surface were detected. Furthermore, any leakage through the bellows assembly is directed to a drain system (refueling bellows seal trough drains) with an alarm to notify operators.

Additionally, the letter stated that in response to Generic Letter (GL) 87-05, "Request for Additional Information - Assessment of Licensee Measures to Mitigate and/or Identify Potential Degradation of Mark I Drywells," ultrasonic testing (UT) thickness measurements of the drywell shell in January 1987 were at 12 locations directly above the sand cushion region detected no loss of wall thickness and hence no discernable corrosion rate.

Actions to monitor drywell corrosion and detect water leakage have been regular and the applicant has remained vigilant. No drywell corrosion nor leakage has been detected.

Based on its review, the staff finds the applicant's response to RAI 2.4.1-2 acceptable because the refueling cavity seal components are classified as not within the scope of license renewal and the above discussed inspections detected no discernable corrosion rate. Therefore, the staff's concern described in RAI 2.4.1-2 is resolved.

In RAI 2.4.1-3 dated August 22, 2006, the staff stated that LRA Table 2.4-2 shows biological shield wall concrete as a component within the scope of license renewal. The staff asked the applicant to clarify whether it needs a cooling system to maintain the temperature of the biological shield wall concrete within its design limit temperatures and, if so, to confirm that the cooling system is included within the scope of license renewal and to list the system in Table 2.4-2.

In its response dated September 13, 2006, the applicant stated:

> PNPS does not require a cooling system, other than the normal drywell and reactor building cooling systems to maintain the temperature of the biological shield wall concrete within its design limit temperatures. Maintaining area temperatures is a normal operating function of the nonsafety-related drywell and reactor building heating, ventilation, and air conditioning systems. Plant technical specifications ensure that the drywell temperature is maintained within appropriate limits. A plant shutdown or engineering evaluation to assess potential damage and render a determination of the ability of the safety-related equipment to perform its intended function is required if the temperature limits are exceeded for more than 24 hours.

Based on its review, the staff finds the applicant's response to RAI 2.4.1-3 acceptable because the systems that maintain the temperature of biological shield wall concrete, the drywell, and reactor building cooling systems are not subject to an AMR based on 10 CFR 54.21(a)(1). Therefore, the staff's concern described in RAI 2.4.1-3 is resolved.

In RAI 2.4.1-4 dated August 22, 2006, the staff stated that with respect to LRA Table 2.4-1, "Primary Containment," lists, "Floor slabs, walls (EQ Zone 1.30, Drywell El. 9'-2")," it is unclear whether the slab is the same as the one at the elevation of the moisture barrier interface between the drywell floor concrete slab and the drywell shell or a different slab. The staff requested from the applicant a drawing to depict the "Floor slabs, walls (EQ Zone 1.30, Drywell El. 9'-2")" and an indication whether all floor slabs and walls inside the primary containment are within the scope of license renewal.

In its response dated September 13, 2006, the applicant stated:

> All floor slabs and walls within primary containment are within the scope of license renewal as listed in LRA Table 2.4-1. This includes the drywell floor slab that interfaces with the drywell shell. Drawings submitted in LRA Amendments 1 and 2 depict EQ Zone 1.30, Drywell El. 9'2" as the elevation of the drywell floor slab.

Based on its review, the staff finds the applicant's response to RAI 2.4.1-4 acceptable because the drawings clearly depict the location of "Floor slabs, walls (EQ Zone 1.30, Drywell El. 9'-2")" as a floor slab. Also, the applicant indicated that all floor and walls within primary containment are within the scope of license renewal. Therefore, the staff's concern described in RAI 2.4.1-4 is resolved.

In RAI 2.4.1-5 dated August 22, 2006, the staff stated that LRA Table 2.4-1, "Primary Containment," does not include the reinforced concrete shield plugs that shield the top of the drywell. The staff requested from the applicant justification for not including them within the scope of license renewal. Exclusion of the reinforced concrete shield plugs from the scope of license renewal may lead to long-term degradation of the plugs (*e.g.*, full sectional concrete cracking, rebar corrosion, loss of bond, partial spalling or cracking of concrete due to handling, loss of load-carrying capacity of plug attachments, etc.). In addition, there was a potential seismic II/I concern for the structural integrity of the drywell head.

In its response dated September 13, 2006, the applicant stated, "The reinforced shield plugs that provide shielding over the top of the drywell are included in LRA Table 2.4-6, 'Bulk Commodities' under line item 'Manway hatches and hatch covers'."

Based on its review, the staff finds the applicant's response to RAI 2.4.1-5 acceptable because shield plugs are included in the LRA. Therefore, the staff's concern described in RAI 2.4.1-5 is resolved.

In RAI 2.4.1-6 dated August 22, 2006, the staff stated that LRA Table 2.4-1, "Primary Containment," lists only the reactor vessel and drywell bellows and requested from the applicant confirmation that backing plates, spring seals, removable guard rings, and such items are within the scope of license renewal and a listing of the items in Table 2.4-1.

In its response dated September 13, 2006, the applicant stated,

> Backing plates, spring seals and removable guard rings along with refueling bellows are part of the refueling cavity seal. The refueling cavity seal components perform no license renewal intended function and are not subject to aging management review as stated in the response to RAI 2.4.1-2.

Based on its review, the staff finds the applicant's response to RAI 2.4.1-6 acceptable on the merit of the justification in the applicant's response to RAI 2.4.1-2. Therefore, the staff's concern described in RAI 2.4.1-6 is resolved.

2.4.1.3 Conclusion

The staff reviewed the LRA, RAI responses, and related structural components 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 with reasonable assurance that the applicant has adequately identified the primary containment components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2 Reactor Building

2.4.2.1 Summary of Technical Information in the Application

LRA Section 2.4.2 describes the reactor building, the primary functions of which are to support and protect the reactor and its systems. The reactor building completely encloses the primary containment. It also houses the refueling facilities, spent fuel storage pool, steam separator and dryer storage pool, new fuel storage vault, and CRD hydraulic equipment. A biological shield wall, part of the reactor building, encircles the primary containment to protect the containment vessel and the reactor system against potential missiles generated outside the primary containment and to provide shielding to reduce dose to personnel. The new fuel storage vault and new fuel storage racks are dry locations for upright storage of new fuel assemblies for their efficient handling during station operations. The spent fuel storage pool, the reactor well, and the steam separator and dryer storage pool are of reinforced concrete with deep girder walls and base slabs lined with stainless steel plates on their inner surfaces.

The reactor building has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the reactor building could prevent satisfactory performance of a safety-related function. In addition, the reactor building performs FP and ATWS functions.

LRA Table 2.4-2 shows the following reactor building component types within the scope of license renewal and subject to an AMR:

Steel and Other Metals

- blow-out or blow-off panels
- equipment lock
- metal partition walls
- metal siding
- new fuel storage racks
- reactor building crane, rails, and girders
- refueling platform
- roof framing and insulated metal decking

- spent fuel pool liner plate and gates
- spent fuel pool storage racks
- structural steel: beams, columns, plates, trusses

Concrete

- beams, columns, floor slabs, and interior walls
- biological shield wall
- exterior walls
- foundations
- masonry walls
- new fuel storage vault
- spent fuel pool bottom slab and walls
- sump
- water trough

LRA Table 2.4-2 shows steel, other metals, and concrete as reactor building component types within the scope of license renewal and subject to an AMR.

The intended functions of the reactor building components within the scope of license renewal include:

- shelter or protection for safety-related equipment, including radiation shielding and pipe whip restraint
- rated fire barrier to confine or retard a fire from spreading
- protective barrier for flood events
- missile barrier
- pressure boundary
- structural or functional support for nonsafety-related equipment the failure of which could impact safety-related equipment
- structural or functional support for safety-related equipment

2.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2 and UFSAR Sections 5.2, 5.3, and 12.2 using the evaluation methodology in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

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

2.4.2.3 Conclusion

The staff reviewed the LRA and related structural components 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 with reasonable assurance that the applicant has adequately identified the reactor building components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.3 Intake Structure

2.4.3.1 Summary of Technical Information in the Application

LRA Section 2.4.3 describes the intake structure, which supports and protects equipment that draws water from the intake canal and houses the SSW system pumps, CWS pumps, fire protection system pumps, chlorination system equipment, stop logs, trash racks, and the traveling screens with their wash pumps. The intake structure consists of a steel-framed superstructure covered by precast concrete panels resting upon a reinforced concrete substructure with a foundation on undisturbed soil. The superstructure primarily houses equipment of the circulating water and SSW systems while the substructure provides a flow path for bay water to reach the suction piping of these systems. Reinforced concrete wing walls extend outward from the front (north) corners of the structure to connect the intake canal and the substructure. Precast concrete panels cover the external walls, and the galvanized steel roof is built up over metal decking and rigid insulation. The SSW pump room exterior walls and ceiling are reinforced concrete. Masonry block walls divide the SSW pump room into three compartments (east, west, and north). Interior walls surrounding the hypochlorite tank and pump are also masonry.

The intake structure has safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the intake structure could prevent satisfactory performance of a safety-related function. In addition, the intake structure performs FP functions.

LRA Table 2.4-3 shows the following intake structure component types within the scope of license renewal and subject to an AMR:

Steel and Other Metals

- baseplates, fasteners, and supports
- metal roof decking
- structural steel: beams, columns, plates

Concrete

- beams, columns, floor slabs, interior walls
- exterior walls
- foundations

- masonry walls
- pump bays
- roof slabs
- skimmer wall
- sump

LRA Table 2.4-3 shows steel and other metals and concrete as intake structure component types within the scope of license renewal and subject to an AMR.

The intended functions of the intake structure components within the scope of license renewal include:

- shelter or protection for safety-related equipment, including radiation shielding and pipe whip restraint
- rated fire barrier to confine or retard a fire from spreading
- protective barrier for flood events
- missile barrier
- structural or functional support for nonsafety-related equipment the failure of which could impact safety-related equipment
- structural or functional support for safety-related equipment
- structural or functional support to equipment required to meet NRC regulations for the five 10 CFR 54.4(a)(3) regulated areas

2.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.4.3 and UFSAR Section 12.2 using the evaluation methodology in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

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

The staff's review of LRA Section 2.4.3 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.4.3-1 dated August 22, 2006, the staff stated that LRA Table 2.4-3, "Intake Structure," does not include intake plant-specific structure components like sluice gates, trash racks, traveling screens, cranes, and water proofing membranes, etc., within the scope of license renewal. The staff requested from the applicant justification for not including such plant-specific components within the scope of license renewal.

In its response dated September 13, 2006, the applicant provided additional information about the following components:

> *Sluice gates*
>
> Sluice gates are addressed in LRA Section 2.3.3.2, "Salt Service Water System," under the component type "valve body" since they act as valves by isolating flow as indicated in response to RAI 2.3.3.2-1.
>
> *Trash racks and traveling screens*
>
> The SSW pumps are located within separate bays that would prevent them from impact should failure of the trash racks occur. The trash racks and traveling screens, located at the entrance to the intake structure, keep debris from entering the circulating and SSW bays. The trash racks are intended to protect the traveling screens from large debris. The trash racks prevent the high circulating velocity water from drawing large debris into the traveling screens during normal plant operation. However, during emergency operations, the circulating water pumps are unnecessary and, in fact, may be unavailable due to loss of offsite power. For normal and emergency operations, the SSW pumps draw a much lower volume of water through the intake bays. The lower flow rates of the SSW system preclude large debris from being drawn into the flow path that could damage the traveling water screens. Therefore, trash racks do not provide a license renewal intended function as defined in 10 CFR 54.4(a)(1), (2) or (3).
>
> The structural supports for the traveling screens are part of the intake structure, which is in-scope for license renewal and subject to aging management review. The traveling screens themselves perform their function with moving parts and a change in configuration and are therefore, not subject to aging management review in accordance with 10 CFR 54.21(a)(1)(i). Therefore, the traveling screens do not require aging management review and are not included in LRA Table 2.4-3.
>
> *Cranes and water proofing membranes*
>
> The PNPS intake structure does not contain an overhead crane, but it does have a nonsafety-related jib crane attached to its exterior concrete wall which may be used in support of maintenance and trash cleaning operation. As there is no safety-related equipment in the vicinity of the jib crane, its failure would not result in loss of intended function of safety-related components. The jib crane does not require aging management review because it does not perform a license renewal intended function. Waterproofing membranes are not utilized in the intake structure.

Based on its review, the staff finds the applicant's response to RAI 2.4.3-1 on sluice gates and waterproofing acceptable. The staff did not agree, however, that use of the SSW pumps at various suction rates precludes the possibility of degraded trash racks and traveling screens allowing unwanted particulates into the system during emergency operation. Therefore, the staff asked the applicant to include trash racks and traveling screens within the scope of license renewal and to describe the monitoring programs for these components. Also, the staff requested from the applicant clarification and additional justification for the statement, "The jib crane does not require aging management review because it does not perform a license renewal intended function."

In its response dated January 16, 2007, the applicant stated that both components are subject to preventive maintenance inspections and actions to monitor and repair material degradation. The applicant added that the jib crane has not been operated in several years, its trash cleanup function is seldom needed and, as a maintenance-intensive piece of equipment, it has been replaced by divers for its infrequent function.

Based on its review, the staff finds the applicant's response to RAI 2.4.3-1 acceptable. The trash racks and traveling screens are subject to periodic maintenance and therefore not subject to an AMR. In addition, divers now perform the non-working jib crane's function.

2.4.3.3 Conclusion

The staff reviewed the LRA, RAI responses, and related structural components 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 with reasonable assurance that the applicant has adequately identified the intake structure components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.4 Process Facilities

2.4.4.1 Summary of Technical Information in the Application

LRA Section 2.4.4 describes the process facilities, buildings and structures for power generation and supporting processes. Process facilities with intended functions for license renewal include the EDG, main stack and filter, radwaste, and turbine buildings. The EDG building supports and protects the EDGs and their equipment. The main stack building ensures an elevated release of appropriately filtered radioactivity. The radwaste building supports and protects the radioactive waste treatment equipment, the control room, the cable spreading and computer rooms, a post-accident sampling station, a warehouse, and miscellaneous offices and shops. The turbine building supports and protects the turbine generator and auxiliaries with its auxiliary bays.

The process facilities have safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the process facility could prevent satisfactory performance of a safety-related function. In addition, the process facilities perform FP functions.

LRA Table 2.4-4 shows the following process facilities component types within the scope of license renewal and subject to an AMR:

Steel and Other Metals

- blowout or blow-off panels
- control room ceiling support system
- crane rails and girders
- main stack
- main stack guy wires
- metal partition walls
- roof framing and insulated metal decking
- structural steel: beams, columns, plates

Concrete

- beams, columns, floor slabs, interior walls
- exterior walls
- foundations
- interior walls (control room envelope)
- main stack chimney
- main stack guy wire deadman
- masonry walls
- roof slabs
- shield walls and plugs
- sumps

LRA Table 2.4-4 shows steel and other metals and concrete as process facility component types within the scope of license renewal and subject to an AMR.

The intended functions of the process facility components within the scope of license renewal include:

- shelter or protection for safety-related equipment, including radiation shielding and pipe whip restraint
- rated fire barrier to confine or retard a fire from spreading
- protective barrier for flood events
- missile barrier
- pressure boundary
- structural or functional support for nonsafety-related equipment the failure of which could impact safety-related equipment
- structural or functional support for safety-related equipment
- structural or functional support for equipment required to meet NRC regulations for the five 10 CFR 54.4(a)(3) regulated areas

2.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.4.4 and UFSAR Sections 12.2 and 12.3 using the evaluation methodology in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

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

The staff's review of LRA Section 2.4.4 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.4.4-1 dated August 22, 2006, the staff requested additional information for LRA Section 2.4.4, "Process Facilities," as to the potential interaction between some seismic Class II SSCs and the tornado-induced failure of the main stack. Specifically, the applicant was asked to confirm that it had taken appropriate measures to preclude potential interactions between the main stack and some nearby seismic Class II SSCs the failure of which might affect seismic Class I SSCs adversely. The main stack is a safety-related and seismic Class I structure but not designed to withstand tornado loadings.

In its response dated September 13, 2006, the applicant stated:

> Review of the main stack and possible interaction with structural commodities confirms that should a tornado-induced failure of the main stack occur, it will not interact with nearby seismic Class II SSCs whose failure might result in loss of intended function of seismic Class I SSCs. As stated in Section 2.4.4, Process Facilities, of the LRA under Main Stack and Filter Building "The main stack ... is located sufficiently far from other seismic Class I structures to preclude interaction." This includes interaction with seismic Class I SSCs caused by interaction with nearby seismic Class II SSCs whose failure might have adverse effects on seismic Class I SSCs.

The staff finds the applicant's response to RAI 2.4.4-1 acceptable because failure of main stack would not affect seismic Class II/I SSCs. Therefore, the staff's concern described in RAI 2.4.4-1 is resolved.

2.4.4.3 Conclusion

The staff reviewed the LRA, RAI responses, and related structural components 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 with reasonable assurance that the applicant has adequately identified the process facilities components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.5 Yard Structures

2.4.5.1 Summary of Technical Information in the Application

LRA Section 2.4.5 describes the yard structures, structures not within the primary containment, the reactor building, the intake structure, or process facilities. Yard structures within the scope of license renewal include: (1) tank foundations; (2) the security diesel generator building; (3) the SBO diesel generator building; (4) transformer foundations; (5) the switchyard relay house and switchyard structural components; (6) trenches, valve pits, manholes, and duct banks; (7) breakwaters, jetties, and revetments; and (8) the discharge structure. Tank foundations support the condensate storage tanks (T-105A/B), which sit on a sand cushion with a concrete ring wall foundation. The security diesel generator building supports and protects the security generator and its auxiliary equipment. The SBO diesel generator enclosure supports and protects plant equipment for the SBO diesel generator. The transformer foundations support the 345kV switchyard startup transformer X4 and the 23kV transformer yard shutdown transformer X13 required for recovery from SBO. The switchyard terminal house supports and protects the control, monitoring, and protective relaying for the 345kV switching station equipment. The trenches, valve pits, manholes, and ductbanks throughout the site support and protect plant equipment. The breakwaters protect the intake structure and revetments from excessive wave action and overtopping due to wave run-up, prevent rapid silting of the dredged channels, and limit storm flooding of the site. The discharge structure located near the shoreline provides a flow path from the CWS and the SSW systems back to the bay.

The yard structures have safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the yard structure could prevent satisfactory performance of a safety-related function. In addition, the yard structures perform FP and SBO functions.

LRA Table 2.4-5 shows the following yard structure component types within the scope of license renewal and subject to an AMR:

Steel and Other Metals

- SBO diesel generator enclosure
- security diesel generator building
- structural steel: beams, column, plates, trusses
- switchyard relay house

Concrete

- beams, columns, floor slabs, interior walls
- discharge structure

- duct banks
- exterior walls
- foundations (switchyard relay house, tanks, SBO diesel generator, security diesel generator building, transformers)
- manholes
- sumps
- trenches
- valve pits

Rip Raps and Capstone

- breakwaters, jetties, and revetments

LRA Table 2.4-5 shows yard structure component types within the scope of license renewal and subject to an AMR:

- steel and other metals
- concrete
- rip raps and capstone

The intended functions of the yard structure components within the scope of license renewal include:

- shelter or protection for safety-related equipment, including radiation shielding and pipe whip restraint
- protective barrier for flood events
- missile barrier
- structural or functional support for nonsafety-related equipment the failure of which could impact safety-related equipment
- structural or functional support for equipment required to meet NRC regulations for the five 10 CFR 54.4(a)(3) regulated areas
- structural or functional support for safety-related equipment

2.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.4.5 and UFSAR Sections 2.4.4.1 and 8.2 using the evaluation methodology in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

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

The staff's review of LRA Section 2.4.5 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.4.5-1 dated August 22, 2006, the staff requested the addition of certain components within the scope of license renewal. LRA Table 2.4-5, "Yard Structures," does not include the plant system portion of switchyard circuit breakers, transformers, transmission towers, and transmission tower foundations. These components are on the list of components needed to comply with interim staff guidance in the April 1, 2002, NRC letter (ML0209204640), "Staff Guidance on Scoping of Equipment Relied on to Meet the Requirements of the Station Blackout (SBO) Rule (10CFR 50.63) For License Renewal (10 CFR 54.4(a)(3)).

In its response dated September 13, 2006, the applicant stated:

> Structural commodities required to support station blackout are included in the scope of license renewal. These commodities include those components discussed in Section 2.4.5 and addressed by the following table line items.
>
> > a) switchyard circuit breaker supports - included in LRA Table 2.4-6 line item "Components and piping supports" and line item "Electrical and instrument panels and enclosures"
> >
> > b) switchyard circuit breaker foundations, transformers and transmission tower foundations - included in LRA Table 2.4-5 line item "Foundation"
> >
> > c) transmission towers - included in LRA Table 2.4-1 line item "Structural steel, beams, columns, plates, trusses"
> >
> > d) switchyard relay house - LRA Table 2.4-5 line item "Switchyard relay house"

Based on its review, the staff finds paragraphs a), b), and d) of the applicant's response to RAI 2.4.5-1 acceptable because components needed to comply with the interim staff guidance on scoping of offsite power systems necessary to support the SBO rule (10 CFR 50.63) are included in the LRA. However, paragraph c) states,"transmission towers - included in LRA Table 2.4-1." The staff also requested from the applicant confirmation that this component is included in LRA Table 2.4-1 and not in LRA Table 2.4-5.

By phone conference on December 12, 2006, the applicant verified that transmission towers are included in LRA Table 2.4-5.

2.4.5.3 Conclusion

The staff reviewed the LRA, RAI responses, and related structural components 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 with reasonable assurance that the applicant has adequately identified the yard structures components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.6 Bulk Commodities

2.4.6.1 Summary of Technical Information in the Application

LRA Section 2.4.6 describes the bulk commodities subject to an AMR, structural components or commodities that perform or support intended functions of in-scope SSCs. Bulk commodities common to in-scope SSCs (*e.g.*, anchors, embedments, component and piping supports, instrument panels and racks, cable trays, and conduits) are addressed in this section.

The bulk commodities have safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the bulk commodity could prevent satisfactory performance of a safety-related function. In addition, the bulk commodities perform FP, ATWS, SBO, and EQ functions.

LRA Table 2.4-6 shows the following bulk commodity component types within the scope of license renewal and subject to an AMR:

Steel and Other Metals

- anchorage/embedments
- base plates
- battery racks
- cable trays
- cable trays support
- component and piping supports ASME Classes 1, 2, 3, and MC
- components and piping supports
- conduits
- conduit supports
- damper framing
- electrical and Instrument panels and enclosures
- fire doors
- fire hose reels
- flood curbs
- flood, pressure and specialty doors
- HVAC duct supports
- instrument line supports
- instrument racks, frames, and tubing trays
- manway hatches and hatch covers
- mirror insulation
- missile shields

- monorails
- penetration sleeves (mechanical/electrical not penetrating primary containment structure boundary)
- pipe whip restraints
- stairways, handrails, platforms, grating, decking, and ladders
- vents and louvers

Threaded Fasteners

- anchor bolts
- ASME Classes 1, 2, 3, and MC support bolting
- structural bolting

Concrete

- equipment pads/ foundations
- fire proofing
- flood curbs
- manway hatches and hatch covers
- missile shields
- support pedestals

Elastomers and Other Materials

- building pressure boundary sealant
- compressible joints and seals
- fire stops
- fire wraps
- insulation
- penetration sealant (fire rated, flood, radiation)
- seals and gaskets (doors, manways, and hatches)
- seismic joint filler
- water stops

LRA Table 2.4-6 shows bulk commodity component types within the scope of license renewal and subject to an AMR:

- steel and other metals
- threaded fasteners
- elastomers and other materials

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

- shelter or protection for safety-related equipment, including radiation shielding and pipe whip restraint
- rated fire barrier to confine or retard a fire from spreading
- protective barrier for flood events

- insulation
- pressure boundary
- structural or functional support for nonsafety-related equipment the failure of which could impact safety-related equipment
- structural or functional support for equipment to meet NRC regulations for the five 10 CFR 54.4(a)(3) regulated areas
- structural or functional support for safety-related equipment

2.4.6.2 Staff Evaluation

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

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

The staff's review of LRA Section 2.4.6 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.4.6-1 dated August 22, 2006, the staff stated that LRA Table 2.4-6, "Bulk Commodities," lists bulk commodities but the location of each component is not clear. The staff requested from the applicant a description of all commodities on the list and a comprehensive listing of components and locations for each commodity.

In its response dated September 13, 2006, the applicant stated:

> As stated in Section 2.4.6, the bulk commodities common to PNPS in-scope structures are listed in Table 2.4-6. Commodities unique to a specific structure are included in the review for that structure (Section 2.4.1 through 2.4.5). The commodities listed in Table 2.4-6 are in-scope and subject to aging management review regardless of which in-scope structure they are within. Components classified as bulk commodities typically have no unique component identification numbers. Therefore, a comprehensive listing of components and locations is not feasible.

Based on its review, the staff finds the applicant's response to RAI 2.4.6-1 acceptable because LRA Table 3.5.2-6 sufficiently describes and indicates AMPs for the components listed in Section 2.4.6. Therefore, the staff's concern described in RAI 2.4.6-1 is resolved.

In RAI 2.4.6-2 dated August 22, 2006, the staff noted that LRA Table 2.4-6, "Bulk Commodities," lists "Insulation" with its intended functions. It was unclear to the staff why "Support for

Criterion (a)(1) equipment" is not listed as an intended function when Table 2.0-1 defines the intended function of insulation as "provide insulating characteristics to reduce heat transfer" meant for safety-related and nonsafety-related components. The staff requested from the applicant additional information on insulation and a list of in-scope components with insulation as an intended function.

In its response dated September 13, 2006, the applicant stated:

> LRA Table 2.4-6 lists two functions for insulation. The first, 'Insulation,' is described in Table 2.0-1 as 'Provide insulating characteristics to reduce heat transfer.' This function does apply to safety-related and nonsafety-related components. The second function, 'Support for Criterion (a)(2) equipment,' is described in Table 2.0-1 as 'Provide structural or functional support to nonsafety-related equipment whose failure could impact safety-related equipment.' This means the nonsafety-related insulation must maintain integrity such that falling insulation does not damage safety-related equipment. Therefore, 'Support for Criterion (a)(1) equipment' need not be listed as a separate intended function for insulation.
>
> Examples of in-scope components that have insulation addressed by this line item in LRA Table 2.4-6 are the recirculation system piping, valves and pump casings, and main steam relief/safety valves.

On the basis of its review, the staff finds the applicant's response to RAI 2.4.6-2 acceptable because the applicant has demonstrated that insulation is included within the scope of license renewal for potential interaction only and that insulating properties are not license renewal intended functions. Therefore, the staff's concerns described in RAI 2.4.6-2 are resolved.

In RAI 2.4.6-3 dated August 22, 2006, the staff noted that LRA Table 2.4.6 lists steel "Flood curbs" as a component with intended functions of flood barrier and shelter or protection and another component, concrete "Flood curbs," with an intended function of flood barrier. The staff requested from the applicant a listing of all structural members (elements) under each of these components.

In its response dated September 13, 2006, the applicant stated:

> At PNPS, flood curbs constructed of either concrete or steel perform the same intended function, which is to provide shelter and protection by serving as flood barriers. In essence, 'flood barrier' and 'shelter or protection' are the same function and both types of flood curb fulfill this function.

Based on its review, the staff finds the applicant's response to RAI 2.4.6-3 acceptable because the applicant clarified that both concrete and steel flood curbs perform the same intended functions. Therefore, the staff's concern described in RAI 2.4.6-3 is resolved.

2.4.6.3 Conclusion

The staff reviewed the LRA, RAI responses, and related structural components 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 with reasonable assurance that the applicant has adequately identified the bulk commodities components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5 <u>Scoping and Screening Results: Electrical and Instrumentation and Control Systems</u>

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 systems
- electrical commodities

Under 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 subject to an AMR.

<u>Staff Evaluation Methodology</u>. 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).

<u>Scoping</u>. In its scoping evaluation, the staff reviewed the applicable LRA sections and component drawings, focusing on components that have not been identified as within the scope of license renewal. The staff reviewed relevant licensing basis documents, including the UFSAR, for each electrical and I&C system to determine whether the applicant has omitted from the scope of license renewal components with intended functions under 10 CFR 54.4(a). The staff also reviewed the licensing basis documents to determine whether the LRA specified all intended functions delineated under 10 CFR 54.4(a). The staff requested additional information to resolve any omissions or discrepancies identified.

<u>Screening</u>. After its review of the scoping results, the staff evaluated the applicant's screening results. For SCs with intended functions, the staff sought to determine whether (1) the functions are performed with moving parts or a change in configuration or properties or (2) the SCs are subject to replacement after a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff sought to confirm that these SCs were subject to an AMR, as required by 10 CFR 54.21(a)(1). The staff requested additional information to resolve any omissions or discrepancies identified.

2.5.1 Summary of Technical Information in the Application

LRA Section 2.5.1 describes the electrical and I&C systems consisting of high-voltage insulators, cables and connections, buses, and electrical portions of electrical and I&C penetration assemblies. In addition to plant electrical systems, certain switchyard components required to restore offsite power following SBO are included conservatively within the scope of license renewal. The offsite power sources required to support SBO recovery actions are fed through the startup transformer (X4) and the shutdown transformer (X13). Specifically, the path includes the switchyard circuit breakers for the startup and shutdown transformers, the transformers, the interconnections from circuit breaker to transformer and from transformer to onsite electrical distribution, control circuits, and structures.

The electrical and I&C systems perform functions that support SBO.

LRA Table 2.5.1-1 shows 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 not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits
- fuse holders (insulation material)
- high-voltage insulators
- inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements
- metal-enclosed bus (non-segregated bus for SBO) connections
- metal-enclosed bus (non-segregated bus for SBO) insulation/insulators
- metal-enclosed bus--enclosure assemblies
- switchyard buses

The electrical and I&C systems component intended functions within the scope of license renewal include:

- electrical connections to deliver voltage, current, or signals
- electrical conductor insulation and support
- structural or functional support for FP, EQ, PTS, ATWS, or SBO

2.5.2 Staff Evaluation

The staff reviewed LRA Section 2.5.1 and the UFSAR using the evaluation methodology in SER Section 2.5 and the guidance in SRP-LR Section 2.5, "Scoping and Screening Results: Electrical and Instrumentation and Controls Systems."

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant 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 under 10 CFR 54.21(a)(1).

The staff's review of LRA Section 2.5 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. Therefore, the staff requested additional information on specific issues to determine whether the applicant had properly applied 10 CFR 54.4(a) scoping criteria and 10 CFR 54.21(a)(1) screening criteria. The applicant responded to the staff's RAIs as discussed below.

In a telephone conference on September 6, 2006, the staff stated that LRA Section 2.5, Table 2.5-1, does not include switchyard bus connections as subject to an AMR and that Section 2.5 does not include non environmentally-qualified electrical penetrations as subject to an AMR. Non environmentally-qualified electrical penetrations within the scope of license renewal are passive, long-live components subject to an AMR.

In its response dated October 6, 2006, the applicant clarified that in LRA Table 2.5-1 the item "Switchyard Bus" includes switchyard bus connections. The applicant added that electrical cables and connections not subject to 10 CFR 50.49 EQ requirements include electrical penetration conductors and connections. Additionally, the structural report for bulk commodities, AMRC-06, addresses in Table 3.5.2-1 the penetration assembly components, seals, and sealing elements that form the radiological control barrier for containment.

Based on its review, the staff finds the applicant's response acceptable because it adequately clarified that switchyard bus connections and non-environmentally qualified electrical penetrations are in LRA Section 2.5 as subject to an AMR.

In RAI 2.5(1) dated July 31, 2006, the staff raised three questions on the following two excerpts from LRA Section 2.5: "The basic philosophy used in the electrical and I&C components IPA is that components are included in the review unless they are specifically screened out. When used with the plant spaces approach, this method eliminates the need for unique identification of every component and its specific location," and, "During the IPA, commodity groups and specific plant systems were eliminated from further review as the intended functions of commodity groups were examined." The staff asked the applicant (1) for all the components screened out and the bases used, (2) whether all plant spaces had been evaluated under this methodology and, if any were not evaluated, for those excluded and the reasons why, and (3) for commodity groups and specific plant systems eliminated from further review and the bases used.

In its response dated August 22, 2006, the applicant stated that source range monitor cables and area radiation monitor cables screened out perform no license renewal intended functions. Source range monitors are nonsafety-related components that provide neutron flux information during reactor startup and low flux level operations. Failure of the source range monitors cannot prevent satisfactory performance of a safety function and the monitors are not relied on to perform a function for compliance with regulations.

High-range area monitors are EQ and replaced based on a qualified life. Other area radiation monitors are nonsafety-related components that warn of abnormal gamma radiation levels in areas where radioactive material may be handled. Failure of these area radiation monitors cannot prevent satisfactory performance of a safety function and these monitors are not relied on to perform a function for compliance with regulations.

The applicant also stated that electrical scoping and screening were based on a bounding approach that included all plant systems irrespective of their spaces. All plant commodity groups were evaluated under this method. The spaces approach is for AMR, not screening. Spaces were not considered in screening.

The applicant further stated that two commodity groups were eliminated from further review, transmission conductors and uninsulated ground conductors. Transmission conductors are uninsulated, stranded electrical cables outside buildings in high-voltage applications.

The UFSAR indicates no license renewal intended function for transmission conductors. They do not meet 10 CFR 54.4 scoping criteria. These components are nonsafety-related per 10 CFR 54.4(a)(1) and their failure cannot prevent satisfactory performance of a 10 CFR 54.4(a)(1) safety function. Transmission conductors are not credited for mitigation of 10 CFR 54.4(a)(3) regulated areas. Transmission conductors are parts of the plant system portion of the offsite power system necessary for recovery of offsite power following an SBO and are subject to an AMR as specified in ISG-2. However, PNPS does not utilize transmission conductors in the plant system portion of the circuits for recovery of offsite power following SBO.

Uninsulated ground conductors (*e.g.*, copper and aluminum cable, copper bar, and steel bar) make ground connections for electrical equipment. These uninsulated ground conductors connect to electrical equipment housings and electrical enclosures as well as the cable tray system, building structural steel, and other metal structural features.

The UFSAR indicates no safety or intended function for license renewal for uninsulated ground conductors. Uninsulated ground conductors enhance electrical system capability to withstand disturbances (*e.g.*, electrical faults, lightning surges) and protect equipment and personnel. Uninsulated ground conductors do not meet 10 CFR 54.4 scoping criteria. These components are nonsafety-related and not credited for mitigation of 10 CFR 54.4(a)(3) regulated areas. Industry and plant-specific operating experience for uninsulated ground conductors indicate no credible failure modes that could prevent satisfactory performance of a 10 CFR 54.4(a)(1) safety function.

Based on its review, the staff finds the applicant's response to RAI 2.5(1) acceptable because it showed in detail that source range monitor cables and area radiation monitor cables had been screened out because they perform no license renewal intended functions. Additionally, high-range monitors are EQ and replaced based on qualified life. Furthermore, transmission conductors were eliminated from further review because PNPS does not utilize transmission conductors in the plant system portion of the circuits for recovery of offsite power following SBO. Uninsulated ground conductors were eliminated from further review because they perform no license renewal intended functions. Therefore, the staff's concern described in RAI 2.5(1) is resolved.

In RAI 2.5(2) dated July 31, 2006, the staff noted that LRA Section 2.5 states that fuse holders with metallic clamps are parts of either a complex active assembly or circuits that perform no license renewal intended function whereas LRA Table 2.5-1 shows "fuse holders (insulation material)" as subject to an AMR. The staff requested (a) confirmation that PNPS does not use fuse holders (with metallic clamps or bolted connections) not parts of larger assemblies but supporting safety-related and nonsafety-related functions but precluding accomplishment of a safety function by the failure of a fuse (10 CFR 54.4(a)(1) and (a)(2)) and (b) revision of Table 2.5-1 accordingly.

In its response dated August 22, 2006, the applicant stated that the PNPS cables and connections commodity group includes fuse holders, which are electrical connections requiring an AMR. The applicant confirmed that fuse holders utilizing metallic clamps or bolted connections are either parts of active components or in circuits with no license renewal function. Therefore, fuse holders with metallic clamps at PNPS are not subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.5(2) acceptable because it showed in detail that the fuse holders with metallic clamps or bolted connections are either parts of active components or in circuits with no license renewal functions and, therefore, not subject to an AMR. The staff's concern described in RAI 2.5(2) is resolved.

In RAI 2.5(3) dated July 31, 2006, the staff noted that LRA Section 2.5 states that electrical cables and connections subject to 10 CFR 50.49 EQ requirements are not subject to an AMR because the components are replaced based on qualified life. The staff requested from the applicant confirmation that all electrical cables and connections subject to 10 CFR 50.49 EQ requirements are replaced based on qualified life (CLB is 40 years).

In its response dated August 22, 2006, the applicant confirmed that all electrical cables and connections subject to 10 CFR 50.49 EQ requirements are replaced based on qualified life.

Based on its review, the staff finds the applicant's response to RAI 2.5(3) acceptable because it showed in detail that all cables and connections subject to 10 CFR 50.49 are replaced based on qualified life and not subject to an AMR. Therefore, the staff's concern described in RAI 2.5(3) is resolved.

2.5.3 Conclusion

The staff reviewed the LRA, UFSAR, and the applicant's supplemental information in its letters dated August 22 and October 6, 2006, 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 with reasonable assurance that the applicant has adequately identified the electrical and I&C systems components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.6 Conclusion for Scoping and Screening

The staff reviewed the information in LRA Section 2, "Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review and Implementation Results," 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 under 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 with reasonable assurance that the applicant will continue to conduct the activities authorized by the renewed license in accordance with the CLB and any changes to the CLB in order to comply 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 Pilgrim Nuclear Power Station (PNPS) by the staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff). In Appendix B of its license renewal application (LRA), Entergy Nuclear Operations, Inc. (ENO or the applicant) described the 38 AMPs that it relies on to manage or monitor the aging of passive, long-lived structures and components (SCs).

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

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

In preparing its LRA, the applicant credited NRC 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) systems, structures, and components (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 selected AMRs and associated AMPs during the weeks of May 22, 2006, and June 19, 2006. The onsite audits and reviews are designed for maximum efficiency of the staff's 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 (ML030990052). 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 PNPS application is essentially the same. The intent of the revised format of the LRA 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 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, engineered safety features, auxiliary systems, etc.). For example, the engineered safety features group has tables specific to the core spray system, high-pressure coolant injection system, and residual heat removal system. Each Table 2 consists of nine columns:

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

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

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

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

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

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

(7) NUREG-1801 Volume 2 Item - The seventh column lists the GALL Report item(s) identified in the LRA as similar to the AMR results. The applicant compares 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 this way the applicant identified the AMR results in the LRA tables corresponding to the items in the GALL Report tables.

(8) Table 1 Item - The eighth column lists the corresponding summary item number from LRA Table 1. If the applicant identifies in each LRA Table 2 AMR results consistent with the GALL Report the Table 1 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.

(9) Notes - The ninth column lists the corresponding notes used to identify how the information in each Table 2 aligns with the information in the GALL Report. The notes, identified by letters, were developed by an NEI work group and will be used in future LRAs. Any plant-specific notes identified by numbers provide additional information about the consistency of the 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 stated were consistent with the GALL Report, the staff conducted either an audit or a technical review to determine such consistency.

(2) For items that the applicant stated were consistent with the GALL Report with exceptions, enhancements, or both, the staff conducted either an audit or a technical review of the item to determine such 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 current licensing basis (CLB) for the period of extended operation, as required by 10 CFR Part 54.

3.0.2.1 Review of AMPs

For 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 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, "GALL Report Volume 2 Item," correlates 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 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 amendments, 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 PNPS Aging Management Programs

PNPS AMP (LRA Section)	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Existing AMPs				
Boraflex Monitoring Program (B.1.1)	Consistent	XI.M22	auxiliary systems	3.0.3.1.1

PNPS AMP (LRA Section)	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
BWR CRD Return Line Nozzle Program (B.1.3)	Consistent with exceptions	XI.M6	reactor vessel, internals, and reactor coolant system	3.0.3.2.2
BWR Feedwater Nozzle Program (B.1.4)	Consistent with exceptions	XI.M5	reactor vessel, internals, and reactor coolant system	3.0.3.2.3
BWR Penetrations Program (B.1.5)	Consistent with exceptions	XI.M8	reactor vessel, internals, and reactor coolant system	3.0.3.2.4
BWR Stress Corrosion Cracking Program (B.1.6)	Consistent with exception and enhancement	XI.M7	reactor vessel, internals, and reactor coolant system	3.0.3.2.5
BWR Vessel ID Attachment Welds Program (B.1.7)	Consistent with exception	XI.M4	reactor vessel, internals, and reactor coolant system	3.0.3.2.6
BWR Vessels Internals Program (B.1.8)	Consistent with exceptions and enhancement	XI.M9	reactor vessel, internals, and reactor coolant system	3.0.3.2.7
Containment Leak Rate Program (B.1.9)	Consistent	XI.S4	engineered safety features systems / structures and component supports	3.0.3.1.2
Diesel Fuel Monitoring Program (B.1.10)	Consistent with exceptions and enhancements	XI.M30	auxiliary systems	3.0.3.2.8
Environmental Qualification (EQ) of Electric Components Program (B.1.11)	Consistent	X.E1	electrical and instrumentation and controls	3.0.3.1.3
Fatigue Monitoring Program (B.1.12)	Consistent	X.M1	reactor vessel, internals, and reactor coolant system / engineered safety features systems / auxiliary systems / steam and power conversion systems / structures and component supports	3.0.3.2.9
Fire Protection Program (B.1.13.1)	Consistent with exceptions and enhancements	XI.M26	auxiliary systems / structures and component supports	3.0.3.2.10
Fire Water System Program (B.1.13.2)	Consistent with exception and enhancements	XI.M27	auxiliary systems	3.0.3.2.11

PNPS AMP (LRA Section)	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Flow-Accelerated Corrosion Program (B.1.14)	Consistent	XI.M17	reactor vessel, internals, and reactor coolant system / auxiliary systems / steam and power conversion systems	3.0.3.1.4
Containment Inservice Inspection Program (B.1.16.1)	Plant-specific		structures and component supports	3.0.3.3.2
Inservice Inspection Program (B.1.16.2)	Plant-specific		reactor vessel, internals, and reactor coolant system / structures and component supports	3.0.3.3.3
Instrument Air Quality Program (B.1.17)	Plant-specific		engineered safety features systems / auxiliary systems	3.0.3.3.4
Oil Analysis Program (B.1.22)	Consistent with exception and enhancements	XI.M39	engineered safety features systems / auxiliary systems	3.0.3.2.13
Periodic Surveillance and Preventive Maintenance Program (B.1.24)	Plant-specific		engineered safety features systems / auxiliary systems / steam and power conversion systems / structures and component supports	3.0.3.3.5
Reactor Head Closure Studs Program (B.1.25)	Consistent with exception	XI.M3	reactor vessel, internals, and reactor coolant system	3.0.3.2.14
Reactor Vessel Surveillance Program (B.1.26)	Consistent with enhancement	XI.M31	reactor vessel, internals, and reactor coolant system	3.0.3.2.15
Service Water Integrity Program (B.1.28)	Consistent with exceptions	XI.M20	auxiliary systems	3.0.3.2.16
Masonry Wall Program (B.1.29.1)	Consistent	XI.S5	structures and component supports	3.0.3.1.10
Structures Monitoring Program (B.1.29.2)	Consistent with enhancements	XI.S6	structures and component supports	3.0.3.2.17
Water Control Structures Monitoring Program (B.1.29.3)	Consistent with enhancement	XI.S7	structures and component supports	3.0.3.2.18
System Walkdown Program (B.1.30)	Consistent	XI.M36	reactor vessel, internals, and reactor coolant system / engineered safety features systems / auxiliary systems / steam and power conversion systems	3.0.3.1.11

PNPS AMP (LRA Section)	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Water Chemistry Control - Auxiliary Systems Program (B.1.32.1)	Plant-specific		auxiliary systems	3.0.3.3.6
Water Chemistry Control - BWR Program (B.1.32.2)	Consistent	XI.M2	reactor vessel, internals, and reactor coolant system / engineered safety features systems / auxiliary systems / steam and power conversion systems	3.0.3.1.13
Water Chemistry Control - Closed Cooling Water Program (B.1.32.3)	Consistent with exception	XI.M21	reactor vessel, internals, and reactor coolant system / engineered safety features systems / auxiliary systems	3.0.3.2.19
New AMPs				
Buried Piping and Tanks Inspection Program (B.1.2)	Consistent with exception	XI.M34	engineered safety features systems / auxiliary systems / steam and power conversion systems	3.0.3.2.1
Heat Exchanger Monitoring Program (B.1.15)	Plant-specific.		engineered safety features systems / auxiliary systems	3.0.3.3.1
Metal-Enclosed Bus Inspection Program (B.1.18)	Consistent with exceptions	XI.E4	electrical and instrumentation and controls	3.0.3.2.12
Non-EQ Inaccessible Medium-Voltage Cable Program (B.1.19)	Consistent	XI.E3	electrical and instrumentation and controls	3.0.3.1.5
Non-EQ Instrumentation Circuits Test Review Program (B.1.20)	Consistent	XI.E2	electrical and instrumentation and controls	3.0.3.1.6
Non-EQ Insulated Cables and Connections Program (B.1.21)	Consistent	XI.E1	electrical and instrumentation and controls	3.0.3.1.7
One-Time Inspection Program (B.1.23)	Consistent	XI.M32 XI.M35	reactor vessel, internals, and reactor coolant system / engineered safety features systems / auxiliary systems	3.0.3.1.8
Selective Leaching Program (B.1.27)	Consistent	XI.M33	engineered safety features systems / auxiliary systems / steam and power conversion systems	3.0.3.1.9

PNPS AMP (LRA Section)	GALL Report Comparison	GALL Report AMPs	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program (B.1.31)	Consistent	XI.M13	reactor vessel, internals, and reactor coolant system	3.0.3.1.12
Bolting Integrity Program (B.1.33)	Consistent with enhancement	XI.M18	reactor vessel, internals, and reactor coolant system / engineered safety features systems / auxiliary systems	3.0.3.2.20
Bolted Cable Connection Program (B.1.34)	Plant-specific		electrical and instrumentation and controls	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:

- Boraflex Monitoring Program
- Containment Leak Rate Program
- EQ of Electric Components Program
- Flow-Accelerated Corrosion Program
- Non-EQ Inaccessible Medium-Voltage Cable Program
- Non-EQ Instrumentation Circuits Test Review Program
- Non-EQ Insulated Cables and Connections Program
- One-Time Inspection Program
- Selective Leaching Program
- Masonry Wall Program
- System Walkdown Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program
- Water Chemistry Control - BWR Program

3.0.3.1.1 Boraflex Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.1, "Boraflex Monitoring," describes the existing Boraflex Monitoring Program as consistent with GALL AMP XI.M22, "Boraflex Monitoring."

The Boraflex Monitoring Program ensures that degradation of the Boraflex panels in the spent fuel racks does not compromise the criticality analysis in support of the design of the spent fuel storage racks. Periodic inspection of the Boraflex, monitoring of silica levels in the spent fuel pool water, and analysis of criticality maintain the required 5-percent subcriticality margin.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.1.

During the audit and review, the staff noted that the program evaluation report did not distinguish the boron-10 areal density gauge for evaluating racks (BADGER) test from the blackness testing. The staff asked the applicant to clarify that its BADGER test is an areal density measurement.

In response, the applicant revised the program evaluation report to clarify that the BADGER test is an areal density measurement.

Based on this revision, the staff finds the applicant's response acceptable.

Operating Experience. LRA Section B.1.1 states that blackness testing on Boraflex panels in the spent fuel storage racks in 1996 and 1998 provided a baseline for development of the monitoring program to maintain the required 5-percent subcriticality margin. The 1996 testing results showed shrinkage and gapping in the Boraflex but no erosion. Analysis of the criticality design of the fuel pool showed that gap sizes and locations had a very minor and negligible effect on rack reactivity. Therefore, the pool subcriticality margin was greater than 5 percent. The 1998 testing results showed about a 20-percent increase in average gap size but much less percentage change in overall shrinkage (gaps and end shortening) of the material. The report concluded that, with no very large gaps, the Boraflex poison material in the spent fuel storage racks continued to perform its intended function. The Boraflex Monitoring Program was instituted recently; therefore, there is no additional plant-specific operating experience.

During the audit and review, the staff asked the applicant to clarify whether its spent fuel pool subcriticality margin of greater than 5 percent is not simply dependent on the blackness test results.

In its response dated September 13, 2006, the applicant revised LRA Section B.1.1.1, "Operating Experience," to clarify that reactivity calculations after direct material surveillance (blackness testing) using bounding assumptions of Boraflex neutron attenuation capacity demonstrated that the 5-percent subcriticality margin had been maintained.

The staff asked the applicant to clarify whether there ever had been BADGER tests at PNPS.

In response, the applicant stated in the Question and Answer Database that the BADGER tests were scheduled for the fourth quarter of 2006.

The staff also asked the applicant to clarify whether it also would rely on BADGER tests to demonstrate the spent fuel pool subcriticality margin of greater than 5 percent.

The applicant responded that the BADGER testing results would be used in calculations to demonstrate that the spent fuel pool subcriticality margin is greater than 5 percent. The staff noted that blackness testing indicates only whether a neutron absorber is present in a Boraflex panel whereas the BADGER test quantitatively measures boron-10 areal density of a neutron absorber in the rack.

After review, the staff finds the applicant's response acceptable because the BADGER device would better indicate Boraflex effectiveness to perform its intended function.

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.2.1.1, the applicant provided the UFSAR supplement for the Boraflex Monitoring Program. The staff reviewed this section and determined 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 audit and review of the applicant's Boraflex Monitoring Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.2 Containment Leak Rate Program

Summary of Technical Information in the Application. LRA Section B.1.9, "Containment Leak Rate," describes the existing Containment Leak Rate Program as consistent with GALL AMP XI.S4, "10 CFR 50, Appendix J."

Containment leak rate tests are required to assure that (a) leakage through the primary reactor containment and systems and components penetrating the primary containment does not exceed allowable limits specified in technical specifications or their bases and (b) periodic surveillance of reactor containment penetrations and isolation valves is performed so proper maintenance and repairs are made during the service life of the containment and its penetrating systems and components.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.2. The staff finds that the Containment Leak Rate Program is consistent with GALL AMP XI.S4, 10 CFR Part 50, Appendix J, including the operating experience attribute.

Operating Experience. LRA Section B.1.9 states that during the most recent integrated leakage testing of the primary containment, as-found and as-left test data met all applicable test acceptance criteria, indicating that the program effectively manages the effects of loss of material and cracking on primary containment components. QA audits in 2000 and 2005 revealed no issues or findings with impact on program effectiveness.

The applicant has demonstrated effective maintenance of the integrity of the containment boundaries by the selection of 10 CFR Part 50, Appendix J, Option B, leakage testing requirements. The staff also reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm that the plant-specific operating experience reveals no degradation not bounded by industry experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.9, the applicant provided the UFSAR supplement for the Containment Leak Rate Program. The staff reviewed this section and determined 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 audit and review of the applicant's Containment Leak Rate Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.3 Environmental Qualification of Electric Components Program

Summary of Technical Information in the Application. LRA Section B.1.11, "Environmental Qualification of Electric Components," describes the existing Environmental Qualification of Electric Components Program as consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components."

The Environmental Qualification of Electric Components Program manages the effects of thermal, radiative, and cyclic aging through aging evaluations 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 refurbished or replaced or their qualification is extended before they reach the aging limits established in the evaluations. Aging evaluations for EQ components are considered time-limited aging analyses (TLAAs) for license renewal.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.3.

During the audit and review, the staff noted that LRA Section 4.4 indicates that for equipment addressed by an EQ TLAA, the effects of aging will be managed in accordance with 10 CFR 54.21(c)(1)(iii) during the period of extended operation. However, information on a reanalysis to extend the qualified life of electrical equipment was not identified. Important reanalysis attributes are the analytical methods, the data collection, the reduction methods, the underlying assumptions, the acceptance criteria, and corrective actions. The staff requested information from the applicant on these important aging evaluation reanalysis attributes to extend the qualification in accordance with 10 CFR 50.49(e) for electrical equipment in the TLAA.

In its response dated July 19, 2006, the applicant added the following text to LRA Section B.1.11 to include the "EQ Component Reanalysis Attributes" specified in the GALL Report, Volume 2, Section X.E1:

> 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 an 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 the station's quality assurance program requirements, which requires the verification of assumption and conclusions. As already noted, 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 below.
>
> Analytical Methods: The analytical models used in the reanalysis of an aging evaluation are the same as those previously applied during the prior evaluation. The Arrhenius methodology is an acceptable model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose (that is, normal radiation dose for the projected installed life plus accident radiation dose). For license renewal, *one acceptable method of establishing the 60-year normal radiation* dose is to multiply the 40-year normal radiation dose by 1.5 (that is 60 years/40 years). The result is added to the accident radiation dose to obtain the total integrated dose for the component. For cyclical aging, a similar approach may be used. Other methods 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, cycles) used in the prior aging evaluation is the chief method used for a reanalysis. Temperature data used in an aging evaluation is to be conservative and based on

plant design temperatures or on actual plant temperature data. When used, plant temperature data can be obtained in several ways, including monitors used for technical specification compliance, other installed monitors, measurement made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurement are [is] conservatively evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as by (a) directly applying the plant temperature data in the evaluation, or (b) using the plant temperature data to demonstrate conservatism when using plant design temperature for an evaluation. Any changes to material activation energy values as part of a reanalysis are to be justified on a plant-specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluation can be used for radiation and cyclical aging.

Underlying Assumption: EQ component aging evaluation[s] 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.

Acceptance Criteria and Corrective Actions: The reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by reanalysis, the component is to be refurbished, replaced, or re-qualified 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 is [if] the reanalysis is unsuccessful.

The staff finds the change to the LRA acceptable as it is consistent with the GALL Report regarding EQ component re-analysis attributes.

GALL AMP X.E1, under "Preventive Actions," states that 10 CFR 50.49 does not require actions that prevent aging effects. EQ programs that may be viewed as preventive actions include (a) establishing component service condition tolerance and aging limits (*e.g.*, qualified life or condition limit) and (b) where applicable, requiring specific installation, inspection, monitoring, or periodic maintenance to maintain component aging effects within the bounds of the qualification basis. The applicant's program evaluation report under the same heading did not include actions that could be viewed as preventive. During the Audit and Review the staff requested from the applicant a description of preventive actions for the Environmental Qualification of Electric Components Program.

In its response, the applicant stated that 10 CFR 50.49 does not require actions that prevent aging effects but revised the program evaluation report (Section 4.10.b.2.b, "Preventive Actions"):

The program actions that could be viewed as preventive actions are the identification of qualified life and specific maintenance/installation requirements.

The staff finds the applicant's response acceptable because the applicant described Environmental Qualification of Electric Components Program actions that could be viewed as preventive.

The staff finds the applicant's EQ of Electric Components Program consistent with the recommended GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components," and acceptable.

Operating Experience. LRA Section B.1.11 states that the excellent operating experience of its systems, structures, and components demonstrates the overall effectiveness of the Environmental Qualification of Electric Components Program that has been improved by periodic internal and external assessments.

The staff reviewed the Environmental Qualification of Electric Components Program self-assessment (January 28, 2002 to February 1, 2002). The assessment found EQ files not updated at the time of the assessment updates were required due to the implementation of plant design change 01-03, Cycle 14 reload design. The impact of the reload design on the program was evaluated in EQ document file References 420D and 420E before Refueling Outage (RFO) 13. All EQ components were to remain qualified for the Cycle 14 reload design. As a result of the assessment, LO-PNPLO-2002-0011 CA-09 was initiated to track and enforce processing of remaining EQ document files per established curves. This action was closed on October 7, 2002.

The staff also interviewed the applicant's technical personnel to confirm that the plant-specific operating experience revealed no degradation not bounded by industry experience.

On the basis of its review and discussions with the applicant's technical personnel, the staff concluded that the applicant's Environmental Qualification of Electric Components Program will adequately manage the aging effects for which this AMP is credited in the LRA.

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.2.1.11, the applicant provided the UFSAR supplement for the Environmental Qualification of Electric Components Program. The staff reviewed this section and determined 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 audit and review of the applicant's Environmental Qualification of Electric Components Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 Flow-Accelerated Corrosion Program

Summary of Technical Information in the Application. LRA Section B.1.14, "Flow-Accelerated Corrosion," describes the existing Flow-Accelerated Corrosion Program as consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion."

This program applies to safety-related and nonsafety-related carbon steel components in systems containing high-energy fluids and carrying two-phase or single-phase high-energy fluid >2 percent of plant operating time. Based on Electric Power Research Institute (EPRI) Report NSAC-202L-R2 recommendations for an effective flow-accelerated corrosion (FAC) program, it predicts, detects, and monitors FAC in plant piping and other pressure-retaining components. This program includes (a) an evaluation to determine critical locations, (b) initial operational inspections to determine the extent of thinning at such locations, and (c) followup inspections to confirm predictions or repair or replace components as necessary.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.4. The staff determined that this AMP is consistent with GALL AMP XI.M17.

Operating Experience. LRA Section B.1.14 states that there were 65 FAC ultrasonic testing (UT) on-line examinations between RFOs 13 and 14 and during RFO 14 (April 2003) of components in the condensate, extraction steam, feedwater, heater vents and drains, main steam, reactor core isolation cooling, and reactor water cleanup systems. Five of the examinations detected decreased wall thickness. Two of the components were accepted after re-evaluation and the other three replaced. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages loss of material in carbon steel components. There were 97 FAC UT on-line examinations between RFOs 14 and 15 and during RFO 15 (April 2005) of components in the condensate, extraction steam, feedwater, heater vents and drains, main steam, reactor core isolation cooling, and reactor water cleanup systems. Three of the examinations detected decreased wall thickness. Two of the components were accepted after re-evaluation and the third was repaired. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages loss of material in carbon steel components. During RFO 15 (April 2005), there were five piping upgrades to FAC-resistant material (American Society for Testing of Materials (ASTM) A335 GR P11). The FAC program document was developed with input from each of the Entergy Nuclear Northeast (ENN) FAC engineers as an ENN standard procedure and includes improvements (*e.g.*, skid-mounted piping now included in the enhanced system susceptibility evaluation) based on ENN plant and other industry operating experience. During RFO 15, several FAC points were added to inspections or re-inspected in response to industry operating experience and the Mihama failure in Japan. A self-assessment in January 2005 revealed no issues or findings with impact on program effectiveness in managing FAC in carbon steel components in systems carrying two-phase or single-phase high-energy fluid > 2 percent of plant operating time.

The staff recognized that the corrective action program, which records internal and external plant-specific operating experience issues, will review and incorporate operating experience for objective evidence of adequate management of the effects of aging.

The staff also reviewed the operating experience described in the basis document and interviewed the applicant's technical personnel to confirm 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 SRP-LR Section A.1.2.3.10. The staff concludes that this program element is acceptable.

On the basis of its review of the operating experience and discussions with the applicant's technical staff, the staff concluded that the applicant's FAC Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

UFSAR Supplement. In LRA Section A.2.1.15, the applicant provided the UFSAR supplement for the Flow-Accelerated Corrosion Program. The staff reviewed this section and determined 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 audit and review of the applicant's Flow-Accelerated Corrosion Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 Non-Environmental Qualification Inaccessible Medium-Voltage Cable Program

Summary of Technical Information in the Application. LRA Section B.1.19, "Non-EQ Inaccessible Medium-Voltage Cable," describes the new Non-EQ Inaccessible Medium-Voltage Cable Program as consistent with GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

In this program, periodic inspections and drainage, as needed, for water collection in cable manholes and conduit prevent cable exposure to significant moisture. The condition of the conductor insulation for in-scope medium-voltage cables exposed to significant moisture will be tested at least every ten years; the specific test type to be determined before the initial test. The program will start prior to the period of extended operation.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.5. The staff also reviewed the program evaluation report.

During the audit and review, the staff noted that under the "detection of aging effects" program element, GALL AMP XI.E3 recommends that the inspection for water collection be on actual plant-specific experience with water accumulation in the manholes; with inspection frequency at least every two years. The Non-EQ Inaccessible Medium-Voltage Cable Program, under the same program element, states that inspection for water collection in cable manholes and conduit will occur at least every two years. The staff asked the applicant to explain how it had considered operating experience for manhole inspection frequency.

In response, the applicant revised the program evaluation report to include the following:

> The inspection will be based on actual plant experience with water accumulation in the manholes and the frequency of inspection will be adjusted based on the results of the evaluation, but the frequency will be at least once every 2 years.

Based on its review, the staff finds the applicant's response acceptable because the criteria for inspection for water collection in the manholes based on actual plant experience with water accumulation are consistent with those of the GALL Report.

GALL AMP XI.E3, under the "scope of program" program element, defines "significant moisture" as periodic exposure lasting less than a few days (*e.g.*, cable in standing water). Significant voltage exposure is defined as subjection to system voltage more than 25 percent of the time. The program evaluation report, under the same program element, states that this program includes inaccessible (*i.e.*, in conduit or buried) medium-voltage cables within the scope of license renewal exposed to significant moisture simultaneously with applied voltage. It does not define "significant" voltage or moisture. In addition, Document AMR-Electrical-01, Revision 2, Section 3.4.1.5, "Non-EQ Inaccessible Medium-Voltage Cable Screening," states that cables susceptible to water treeing are exposed to significant moisture (submerged for years). The staff asked the applicant to revise the AMP B.1.19 program evaluation report for consistency with the GALL Report's scope or to explain how inaccessible medium-voltage cable exposed to significant moisture more than a few days and less than a few years is not susceptible to water treeing.

In its response, the applicant revised the program evaluation report:

> This program applies to inaccessible (*e.g.*, in conduit or direct buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with significant voltage. Significant moisture is defined as periodic exposure to moisture that last more than a few days (*e.g.*, cable in standing water). Periodic exposure to moisture that lasts less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than 25 percent of the time.

Based on its review, the staff finds the applicant's response acceptable because the scope of the program is consistent with that of the GALL Report.

The staff also asked the applicant whether it inspects water in manholes under procedures for such inspections and, if so, for a copy of the procedures.

The applicant responded that it has no formal procedure but a repetitive task and job plan for inspecting manholes. The applicant committed to develop a formal procedure to inspect manholes for in-scope medium voltage cable. In its response dated September 13, 2006, the applicant issued a revised list of regulatory commitments (Commitment No. 15). The applicant also revised the program evaluation report section on operating experience to address the process for considering plant-specific operating experience during implementation of the Non-EQ Medium-Voltage Cable Program.

Based on its review, the staff finds the response acceptable because the applicant inspects manholes for water collection and committed to develop a formal procedure to prevent cable exposure to significant moisture.

GALL AMP XI.E3 defines medium-voltage as ranging from 2 to 35 kilovolts (kV). The program evaluation report lists medium-voltage cables from 2 kV to 23 kV. During the Audit and Review the staff requested from the applicant the definition of "medium-voltage" cable in the LRA for consistency with the GALL Report or a justification of why water tree (the effects of significant moisture to energized medium-voltage cables) would not affect inaccessible medium-voltage cable greater than 23 kV.

In its response dated July 19, 2006, the applicant revised the LRA Section B.1.19 program description to state:

> In-scope medium-voltage includes cable with operating voltage from 2 kV to 35 kV.

Based on its review, the staff finds the applicant's response acceptable because the definition of "medium voltage" is consistent with that of the GALL Report.

Under the "parameters monitored/inspected" program element, the GALL Report states that the specific test type determined before the initial test should be a power factor, partial discharge test, polarization index as described in EPRI TR-103834-P1, or other state-of-the-art testing proven for detecting deterioration of insulation systems due to wetting. The program evaluation report under the same program element stated only that the specific type of test would be determined before the initial test. The staff asked the applicant to revise the program evaluation report for consistency with the GALL Report or explain how its test would be in accordance with the industry guideline.

In its response, the applicant revised the program evaluation report to state that the specific test type determined before the initial test will be proven for detecting deterioration of insulation systems due to wetting as described in EPRI TR-103834-P1-2 or other state-of-the-art testing.

Based on its review, the staff finds the applicant's response acceptable because the test will be in accordance with the industry guideline.

The staff finds the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program acceptable because it is consistent with the recommended GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

<u>Operating Experience</u>. LRA Section B.1.19 states that there is no operating experience for the new Non-EQ Inaccessible Medium-Voltage Cable Program.

GALL AMP XI.E3 indicates that operating experience shows that degradation of cables and connections within the scope of GALL AMP XI.E3 is possible. Cross-linked polyethylene or polyethylene insulation materials of high molecular weight are most susceptible to water tree formation. The formation and growth of water tree varies directly with operating voltage. Water tree is much less prevalent in 4-kV cables than in those operated at 13 or 33 kV and minimal exposure to moisture minimizes potential development of water treeing. The staff requested the applicant's industrial and plant-specific operating experience for this program.

In its response dated July 19, 2006, the applicant revised LRA Section B.1.19 to state:

> The Non-EQ Inaccessible Medium-Voltage Cable Program at PNPS is a new program. Industry and plant-specific operating experience will be considered in the development of this program. Industry operating experience that forms the basis for the program is described in the operating experience element of the GALL Report program description. PNPS plant-specific operating experience is consistent with the operating experience in the GALL Report program description.
>
> The PNPS program is based on the program description in the GALL Report, which in turn is based on industry operating experience. As such, the operating experience used for implementation of the Non-EQ Inaccessible Medium-Voltage Cable Program will provide reasonable assurance that effects of aging will be managed such that applicable components will continue perform their intended functions consistent with the CLB for the period of extended operation.

Based on its review, the staff finds the response acceptable because the applicant has reviewed the plant-specific operating experience against the industry experience described in the GALL Report. With additional operating experience lessons learned can adjust the program elements.

On the basis of its review of the operating experience and discussions with the applicant's technical personnel, the staff concludes that the Non-EQ Inaccessible Medium-Voltage Cable Program will adequately manage the aging effects 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 concludes that this program element is acceptable.

UFSAR Supplement. In LRA Section A.2.1.21, the applicant provided the UFSAR supplement for the Non-EQ Inaccessible Medium-Voltage Cable Program. In a letter dated September 13, 2006, the applicant committed (Commitment No. 15) to implement the Non-EQ Inaccessible Medium-Voltage Cable Program as described in LRA Section B.1.19, including a formal procedure for in-scope medium voltage cable manhole inspections prior to the period of extended operation.

The staff reviewed this section and determined that, upon implementation of Commitment No. 15, 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 audit and review of the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program, with the addition of Commitment No. 15, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that, with the addition of Commitment No. 15, it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 Non-Environmental Qualification Instrumentation Circuits Test Review Program

Summary of Technical Information in the Application. LRA Section B.1.20, "Non-EQ Instrumentation Circuits Test Review," describes the new Non-EQ Instrumentation Circuits Test Review 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."

The Non-EQ Instrumentation Circuits Test Review Program will maintain intended functions of instrument cables exposed to adverse environments of heat, radiation, and moisture consistent with the CLB through the period of extended operation. An adverse environment is significantly more severe than the service environment specified for the cable. This program will consider the technical information and guidance of NUREG/CR-5643, Institute of Electrical and Electronics Engineers Standard (IEEE Std.) P1205, Sandia National Laboratory (SAND)96-0344, and EPRI TR-109619. The program will start prior to the period of extended operation.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.6.

During the audit and review, the staff noted that GALL AMP XI.E2 recommends test frequency based on an engineering evaluation, but at least every 10 years. The program evaluation report, under the same attribute, states that for neutron flux monitoring system cables disconnected during instrument calibration, testing is at least every 10 years. The staff asked the applicant to explain how it considered engineering evaluation for the test frequency.

In its response dated July 19, 2006, the applicant revised the LRA Section B.1.20 program description to include the following clarification:

> The first test of neutron monitoring system cables that are disconnected during instrument calibrations shall be completed before the period of extended operation and subsequent tests will occur at least once every 10 years. In accordance with the corrective action program, an engineering evaluation will be performed when test acceptance criteria are not met and corrective actions, including modified inspection frequency, will be implemented to ensure that the intended functions of the cables can be maintained consistent with the current licensing basis for the period of extended operation.

Based on its review, the staff finds the applicant's response acceptable because testing frequency will be at least every 10 years and a modified testing frequency based on an engineering evaluation will be implemented when acceptance criteria are not met to maintain cable intended functions consistent with the CLB. The program evaluation report was revised to include this clarification.

GALL AMP XI.E2, under the "parameters monitored/inspected" program element, states that the parameters monitored are determined from specific calibration, surveillance, or testing and based on the specific instrumentation under surveillance or calibrated as documented in plant procedures. The program evaluation report, under the same program element, states that the results of calibration or surveillance of components within the scope of license renewal will be reviewed and that the parameters will be based on the specific instrumentation circuit under surveillance or calibrated as documented in the plant calibration or surveillance procedures. During the Audit and Review the staff requested an explanation why the review of calibration results was under the "parameters monitored/inspected" program element and why the program evaluation report did not refer to cable testing parameters. The staff also asked the applicant to confirm that cable testing will be on in-scope cables disconnected during instrument calibration.

In its response, the applicant revised the program evaluation report to state:

> The parameters monitored are determined from the specific calibration, surveillance or testing performed and are based on the specific instrumentation circuit under surveillance or being calibrated, as documented in plant procedures.

The applicant also confirmed that cable testing is by plant procedures on cables within the scope of GALL AMP XI.E2 that are disconnected during instrument calibration.

Based on its review, the staff finds the applicant's response acceptable because the revised program element "parameters monitored/inspected" was consistent with that of GALL AMP XI.E2.

Operating Experience. LRA Section B.1.20 states that there is no operating experience for the new Non-EQ Instrumentation Circuits Test Review Program. Industry and plant-specific operating experience will be considered in the development of this program and future operating experience incorporated appropriately.

GALL AMP XI.E2 indicates that operating experience shows that degradation of cables and connections within the scope of GALL AMP XI.E2 is possible. Operating experience shows a case where a change in temperature across a high-range monitor cable in containment caused substantial change in the monitor display. Changes in instrument calibration can be caused by circuit cable degradation and indicate possible electrical cable degradation. Most plant-specific and industry operating experience with neutron flux instrumentation circuits relates to cable/connector issues inside of containment near the reactor vessel (RV). The staff requested the applicant's industry and plant-specific operating experience for this program.

In its response dated July 19, 2006, the applicant revised LRA Section B.1.20 to state that the Non-EQ Instrumentation Circuits Test Review Program is new and that industry and plant-specific operating experience will be considered in its development. Industry operating experience that forms the basis for the program is included in the GALL Report program description.

The applicant's program is based on the GALL Report program description, which in turn is based on industry operating experience; therefore, the operating experience for the Non-EQ Instrumentation Circuits Test Review Program will provide reasonable assurance that effects of aging will be managed so components will continue to perform intended functions consistent with the CLB for the period of extended operation.

Based on its review, the staff finds the response acceptable because the applicant has reviewed the plant-specific against industry operating experience described in the GALL Report. With additional operating experience, lessons learned can adjust the program elements.

On the basis of its review of the operating experience and discussions with the applicant's technical personnel, the staff concludes that the applicant's Non-EQ Instrumentation Circuits Test Review Program will adequately manage the aging effects 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. In LRA Section A.2.1.22, the applicant provided the UFSAR supplement for the Non-EQ Instrumentation Circuits Test Review Program. In a letter dated September 13, 2006, the applicant stated that it will implement the Non-EQ Instrumentation Circuits Test Review Program as described in LRA Section B.1.20 before the period of extended operation (Commitment No. 16).

The staff reviewed this section and determined 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 audit and review of the applicant's Non-EQ Instrumentation Circuits Test Review Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.7 Non-Environmental Qualification Insulated Cables and Connections Program

Summary of Technical Information in the Application. LRA Section B.1.21, "Non-EQ Insulated Cables and Connections," describes the new Non-EQ Insulated Cables and Connections Program as consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

The Non-EQ Insulated Cables and Connections Program will maintain intended functions of insulated cables and connections exposed to adverse environments of heat, radiation, and moisture consistent with the CLB through the period of extended operation. An adverse environment is significantly more severe than the service environment specified for the insulated cable or connection. A representative sample of accessible insulated cables and connections within the scope of license renewal will be inspected visually for embrittlement, discoloration, cracking, surface contamination, and other cable and connection jacket surface anomalies. The technical basis for sampling will be determined in accordance with EPRI TR-109619, "Guideline for the Management of Adverse Localized Equipment Environments." The program will start prior to the period of extended operation.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.7.

During the audit and review, the staff noted that GALL AMP XI.E1, under "program description," states that the program is written specifically for cables and connections at plants configured so most (if not all) cables and connections installed in adverse environments are accessible. The applicant's AMP B.1.21, under the same element, states that a representative sample of accessible insulated cables and connections within the scope of license renewal will be inspected visually for embrittlement, discoloration, cracking, surface contamination, and other cable and connection jacket surface anomalies. During the Audit and Review the staff requested from the applicant an explanation of the technical basis for cable sampling.

In its response dated July 19, 2006, the applicant revised LRA Section B.1.19 program description:

> This program addresses cables and connections at plants whose configuration is such that most cables and connections installed in adverse localized environments are accessible. This program can be thought of as a sampling program. Selected cables and connections from accessible areas will be inspected and represent, with reasonable assurance, all cables and connections in the adverse localized environments. If an unacceptable condition or situation is identified for a cable or connection in the inspecting sample, a determination will be made as to whether the same condition or situation is applicable to other accessible cables or connections. The sample size will be increased based on an evaluation per the corrective program.

Based on its review, the staff finds the applicant's response acceptable because it provided a technical basis for cable sampling consistent with that of the GALL Report.

Operating Experience. LRA Section B.1.21 states that there is no operating experience for the new Non-EQ Insulated Cables and Connections Program.

GALL AMP XI.E1 indicates that operating experience shows that degradation of cables and connections within the scope of GALL AMP XI.E1 is possible. Operating experience shows that adverse environments caused by heat or radiation for electrical cables and connections may exist next to or above (within 3 feet of) steam generators, pressurizers, or hot process pipes (*e.g.*, feedwater lines). These adverse environments have caused degradation of insulating materials on electrical cables and connections visually observable in color changes or surface cracking. The staff requested the applicant's industrial and plant-specific operating experience for this program.

In its response dated July 19, 2006, the applicant revised the Non-EQ Insulated Cables and Connections Program to state that industry and plant-specific operating experience will be considered in its development. Industry operating experience that forms the basis for the program is included in the operating experience element of the GALL Report program description and the applicant will monitor to verify that plant-specific operating experience is consistent.

The applicant's program is based on the GALL Report program description, which in turn is based on industry operating experience; therefore, the operating experience for the Non-EQ Insulated Cables and Connections Program will provide reasonable assurance that effects of aging will be managed so components will continue to perform intended functions consistent with the CLB for the period of extended operation.

Based on its review, the staff finds the response acceptable because the applicant will review plant-specific operating experience against the industry experience described in the GALL Report. With additional operating experience lessons learned, the applicant can adjust the program elements.

On the basis of its review of the operating experience and discussions with the applicant's technical personnel, the staff concludes that the applicant's Non-EQ Insulated Cables and Connections Program will adequately manage the aging effects 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. In LRA Section A.2.1.23, the applicant provided the UFSAR supplement for the Non-EQ Insulated Cables and Connections Program. In a letter dated September 13, 2006, *the applicant stated that it will implement the Non-EQ Insulated Cables and Connections* Program as described in LRA Section B.1.21 before the period of extended operation (Commitment No. 17).

The staff reviewed this section and determined 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 audit and review of the applicant's Non-EQ Insulated Cables and Connections Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 One-Time Inspection Program

Summary of Technical Information in the Application. LRA Section B.1.23, "One-Time Inspection," describes the new One-Time Inspection Program as consistent with GALL AMPs XI.M32, "One-Time Inspection," and XI.M35, "One-Time Inspection of ASME Code Class I Small-Bore Piping."

The One-Time Inspection Program will be implemented prior to the period of extended operation. The one-time inspection activity for small-bore piping in the reactor coolant system and systems that form the reactor coolant pressure boundary will be comparable to GALL AMP XI.M35 and verify the effectiveness of the AMP to confirm the absence of aging effects.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.8.

During the audit and review, the staff asked the applicant how the sample of piping welds four inches and smaller will be selected for nondestructive examination.

The applicant responded that the One-Time Inspection Program will inspect small-bore piping in the reactor coolant system and systems that form the reactor coolant pressure boundary. This inspection will include a statistically significant sample of welds of each material and environment combination in Class 1 piping equal to or less than 4-inch nominal pipe size (NPS). The initial population will include all Class 1 small-bore piping, and actual locations will be selected for physical location, exposure levels, nondestructive examination (NDE) techniques, and locations specified in NRC Information Notice (IN) 97-46, "Un-Isolable Crack in High-Pressure Injection Piping." The staff further asked the applicant to clarify whether it uses volumetric examinations to detect cracking in butt welds.

In its response, the applicant revised the program evaluation report to state:

> Combinations of non-destructive examinations (including VT-1, enhanced VT-1, ultrasonic, and surface techniques) will be performed by qualified personnel following procedures that are consistent with Section XI of ASME Code and 10CFR50, Appendix B. Volumetric examinations are used to detect cracking in butt welds. Actual inspection locations will be based on physical accessibility, exposure levels, NDE techniques and locations identified in NRC IN 97-46, "Un-isolable Crack in High-Pressure Injection piping."

Based on the above, the staff found the response acceptable.

During the audit and review, the staff asked the applicant how it will handle the aging of small piping socket welds.

The applicant responded that during the fourth inservice inspection (ISI) interval it plans both VT-2 and penetrant testing (PT) examinations, at a minimum, of socket welds in accordance with the fourth interval ISI program plan. The one-time inspection of small-bore piping does not exclude locations based on geometry. Therefore, Class 1 small-bore piping socket welds will be selected for one-time inspection based on physical location and exposure levels.
In a letter dated September 13, 2006, the applicant stated that the One-Time Inspection Program will also include destructive or nondestructive examination of one socket-welded connection using techniques proven by past industry experience to be effective for the identification of cracking in small-bore socket welds. Should an inspection opportunity not occur (e.g., socket weld failure or socket weld replacement), a susceptible small-bore socket weld will be examined either destructively or nondestructively prior to entering the period of extended operation. Since small-bore piping socket-weld connection will be either destructively or nondestructively examined at least once, the staff found the applicant's response acceptable.

Upon further discussions the staff concluded that the destructive or nondestructive examination of one or more socket welds would not contribute significant additional information on the condition of socket welds. Socket welds fail by vibrational fatigue with cracks initiating from their inside surfaces. The time required for fatigue crack initiation is very long compared to the time to propagate through a wall. Therefore, a surface examination or destructive examination of a socket weld is unlikely to detect problems. In addition, there is no history of significant socket weld failures. The staff presented this information to the Advisory Committee on Reactor Safeguards (ACRS) Subcommittee on the Oyster Creek License Renewal on January 18, 2007, and it accepted the staff conclusions on socket welds.

In a letter dated February 23, 2007, the applicant amended Commitment No. 20 to remove references to socket welds.

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 GALL AMP XI.M35 and found that they are consistent with these GALL AMPs. On the basis of its review, the staff concludes that the applicant's One-Time Inspection Program provided assurance that either the aging effect is indeed not occurring, or 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 Program acceptable because it conforms to the recommended GALL AMP XI.M32, "One-Time Inspection" and GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping."

Operating Experience. LRA Section B.1.23 states that there is no operating experience for the new One-Time Inspection Program. Industry and plant-specific operating experience will be considered appropriately in the development of this program.

As this program is new, the staff reviewed the License Renewal Project Operating Experience Review Report in general for small-pipe issues. This report provides information from condition reports and program owner interviews and covers the last five years. The staff determined that the applicant has a good corrective action program that promptly detects age-related degradation.

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.2.1.25, the applicant provided the UFSAR supplement for the One-Time Inspection Program. During the audit and review, the staff noted that the applicant's description of the One-Time Inspection Program in the UFSAR supplement in LRA Appendix A did not include, as a commitment, implementation of the new program Nor did it indicate that this program is new. The applicant was asked to justify why LRA Appendix A did not include a commitment for the new program.

In its response dated September 13, 2006, the applicant included Commitment No. 20 for implementation of this new program. Commitment No. 20 also includes the one-time destructive or nondestructive examination of small-bore socket weld connections.

As a result of the staff's presentation to the ACRS on January 18, 2007, the applicant has since amended Commitment No. 20 to remove references to socket welds.

The staff reviewed this section and determined 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 audit and review of the applicant's One-Time Inspection Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the

UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 Selective Leaching Program

Summary of Technical Information in the Application. LRA Section B.1.27, "Selective Leaching," describes the new Selective Leaching Program as consistent with GALL AMP XI.M33, "Selective Leaching of Materials."

The Selective Leaching Program will ensure the integrity of components made of cast iron, bronze, brass, and other alloys exposed to raw water, treated water, or groundwater that may cause selective leaching. The program will include a one-time visual inspection and hardness measurement of selected components that may be susceptible to determine whether loss of material due to selective leaching has occurred and whether the loss will affect component ability to perform intended functions for the period of extended operation. The program will start prior to the period of extended operation.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.9.

Based on its review, the staff finds the Selective Leaching Program consistent with GALL AMP XI.M33, "Selective Leaching of Materials," including the operating experience attribute.

Operating Experience. LRA Section B.1.27 states that there is no operating experience for the new Selective Leaching Program.

During the audit and review, the staff requested operating experience with circulating water pump replacement due to selective leaching. The applicant responded that it had replaced P-105A ("A" circulating sea water pump) in RFO 15 (April 2005) when the vendor (Flowserve) informed it that a cast iron circulating water pump failure had occurred at the New Boston Fossil Station in 2004 due to graphitization. That pump was of a design similar to that of the PNPS pump with six additional years of submerged operation in salt water. Six core samples of the pump casing were sent out to a materials laboratory for analysis, and the results confirmed graphitization. The applicant plans to replace P-105B in RFO 17 based on the core sample analysis from P-105A columns. The applicant also has purchased columns for P-105B overhaul/replacement onsite. The new pump columns are cast iron enhanced with the addition of 3 to 5 percent nickel to improve strength and graphitization resistance. The original columns were ASTM A48 CL 35 with 1.75- to 2.25-percent nickel.

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.2.1.29, the applicant provided the UFSAR supplement for the Selective Leaching Program. The description in LRA Appendix A did not indicate that this program is new nor did it include a commitment to implement it. The applicant was asked why LRA Appendix A did not include a commitment for the new program.

In its response dated September 13, 2006, the applicant stated that this commitment (Commitment No. 23) will be implemented before the period of extended operation.

The staff reviewed this section and determined that, upon the implementation of Commitment No. 23, 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 audit and review of the applicant's Selective Leaching Program, the staff finds all program elements, with the addition of Commitment No. 23, 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, with Commitment No. 23, provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.10 Masonry Wall Program

Summary of Technical Information in the Application. LRA Section B.1.29.1, "Masonry Wall," describes the existing Masonry Wall Program as consistent with GALL AMP XI.S5, "Masonry Wall Program."

The Masonry Wall Program manages aging effects to validate the evaluation basis established for each masonry wall within the scope of license renewal through the period of extended operation. The program includes all masonry walls with intended functions in accordance with 10 CFR 54.4. Included components are masonry walls required by 10 CFR 50.48, radiation-shielding masonry walls, masonry walls that could affect safety-related components, and the torus compartment water trough. Masonry walls are examined visually at a frequency ensuring 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 and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.10.

Based on its review, the staff finds the Masonry Wall Program consistent with GALL AMP XI.S5, "Masonry Wall Program," including the operating experience attribute.

Operating Experience. LRA Section B.1.29.1 states that examinations of masonry walls within the scope of license renewal in 2002 found no evidence of cracking. A review of condition reports from 1998 through 2004 revealed no instances of cracked masonry walls. The LRA states that the absence of cracking provides evidence that the program is effective for managing the effects of cracking of masonry walls.

The staff did not agree with the applicant that the absence of cracking provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of cracking.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.31, the applicant provided the UFSAR supplement for the Masonry Wall Program. The staff reviewed this section and determined 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 audit and review of the applicant's Masonry Wall Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.11 System Walkdown Program

Summary of Technical Information in the Application. LRA Section B.1.30, "System Walkdown," describes the existing System Walkdown Program as consistent with GALL AMP XI.M36, "External Surfaces Monitoring."

This program inspects external surfaces of components subject to an AMR. The program also is credited with managing loss of material from internal surfaces where internal and external material-environment combinations are the same and the external surface condition represents the internal.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.11.

During the audit and review, the staff asked the applicant why an enhancement to the scoping of the System Walkdown Program is listed in the program evaluation report but not in the LRA. The applicant explained that this enhancement was made after the LRA had been submitted for review and would be added to LRA Section B.1.30 as described below in SER Section 3.0.3.1.11.

Based on its review, the staff finds the applicant's System Walkdown Program acceptable as consistent with the recommended GALL AMP XI.M36, "External Surfaces Monitoring," with an enhancement.

Enhancement. In its response dated September 13, 2006, the applicant revised LRA Section B.1.30 to add the following enhancement to the scope of program element (Commitment No. 28). Specifically the enhancement stated:

> Enhance system walkdown guidance documents to clarify a license renewal

commitment. The commitment for license renewal is for periodic system engineer inspections of systems in-scope and subject to AMR for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in-scope and subject to AMR for license renewal in accordance with 10 CFR 54.4 (a)(2).

The staff reviewed the applicant's enhancement and the plant procedure for system walkdowns and found this enhancement acceptable because it will make the program consistent with GALL AMP XI.M36, Element 1.

On this basis, the staff finds the enhancement acceptable because when implemented the System Walkdown Program will be consistent with GALL AMP XI.M36 and will add assurance of adequate management of aging effects.

Operating Experience. LRA Section B.1.30 states that system walkdowns between 1998 and 2004 found evidence of aging effects including fire water storage tank and diesel fire pump fuel oil day tank leakage, through-wall leakage on salt service water (SSW) piping, corrosion in fan room and auxiliary bays, and through-wall leakage on a drain line to the auxiliary bay sump. Corrective actions were in accordance with the site corrective action program. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects for passive components.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.34, the applicant provided the UFSAR supplement for the System Walkdown Program. In its letter dated July 5, 2006, the applicant revised LRA Section B.1.30 to add this enhancement as Commitment No. 28.

The staff reviewed this section and determined 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 audit and review of the applicant's System Walkdown Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.12 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program

Summary of Technical Information in the Application. LRA Section B.1.31, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel," describes the new Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program as consistent with GALL AMP XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)."

The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program assures that reduction of fracture toughness due to thermal aging and radiation embrittlement will not cause loss of intended function. This program will evaluate CASS components in the RV internals and require NDEs as appropriate. The program will start prior to the period of extended operation.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.12.

Based on its review, the staff finds the applicant's Thermal Aging and Neutron Irradiation Embrittlement of CASS Program acceptable as consistent with the recommended GALL AMP X.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)."

Operating Experience. LRA Section B.1.31 states that there is no operating experience for the new Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program.

The staff also reviewed the operating experience in the basis document and interviewed the applicant's technical personnel to confirm that there is no industry operating experience with thermal aging and neutron irradiation embrittlement of CASS.

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.2.1.35, the applicant provided the UFSAR supplement for the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program. In a letter dated September 13, 2006, the applicant submitted Commitment No. 29 to address this issue.

The staff reviewed this section and, upon implementation of Commitment No. 29, determined 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 audit and review of the applicant's Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.13 Water Chemistry Control - BWR Program

Summary of Technical Information in the Application. LRA Section B.1.32.2, "Water Chemistry Control - BWR," describes the existing Water Chemistry Control-BWR Program as consistent with GALL AMP XI.M2, "Water Chemistry."

To manage aging effects caused by corrosion and cracking mechanisms the program relies on monitoring and control of water chemistry based on EPRI Report 1008192 (Boiling Water Reactor Vessel and Internals Project (BWRVIP)-130). BWRVIP-130 has three sets of guidelines: for primary water; for condensate and feedwater; and for control rod drive (CRD) mechanism cooling water. EPRI guidelines in BWRVIP-130 also include recommendations for controlling water chemistry in the torus, condensate storage tanks, demineralized water storage tanks, and spent fuel pool. The Water Chemistry Control - BWR Program optimizes the primary water chemistry to minimize potential loss of material and cracking by limiting causative contaminant levels in the reactor coolant system. Additionally, the applicant has instituted hydrogen water chemistry to limit the potential for intergranular stress corrosion cracking (IGSCC) through the reduction of dissolved oxygen in the treated water.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed evaluation of this AMP in Audit and Review Report Section 3.0.3.1.13.

GALL AMP XI.M2 recommends that for "susceptible locations" a one-time inspection program verification program may be appropriate. The staff asked the applicant whether it intended to implement a one-time inspection program for this water chemistry control program and, if so, why this intent is not included in the UFSAR supplement, Appendix A.

In response, the applicant stated that the One-Time Inspection Program described in LRA Section B.1.23 includes inspections to verify the effectiveness of the water chemistry control AMPs by confirming that unacceptable cracking, loss of material, and fouling has not occurred. The discussions in LRA Section 3, Table 1 link the One-Time Inspection Program and water chemistry control programs for susceptible components; however, for clarity, in its response dated July 19, 2006, the applicant stated that the effectiveness of the Water Chemistry Control – Auxiliary Systems, BWR, and Closed Cooling Water Programs is confirmed by the One-Time Inspection Program.

With the change to Appendix A the staff finds the applicant's response acceptable.

The staff finds the applicant's Water Chemistry – BWR Program acceptable as consistent with the recommended GALL AMP XI.M2, "Water Chemistry."

Operating Experience. LRA Section B.1.32.2 states that from 1998 through 2004 after several condition reports of adverse trends in parameters monitored by the Water Chemistry Control - BWR Program the applicant acted within the corrective action program to preclude unacceptable parameter values. Continuous confirmation of water quality and corrective actions taken before adverse trends reach control limits provide evidence that the program effectively manages component aging effects. From 1998 through 2004, after several condition reports of parameters monitored by the Water Chemistry Control - BWR Program were outside administrative limits but still within EPRI acceptance criteria and the applicant acted within the corrective action program to preclude violations of EPRI acceptance criteria. Continuous confirmation of water quality and corrective action before parameters reach control limits provide evidence that the program effectively manages component aging effects.

From 1998 through 2004, there were two incidents in which parameters monitored by the Water Chemistry Control-BWR Program were outside of EPRI acceptance criteria:

(1) Following a power outage on March 29, 2002, dissolved oxygen measurement from the B high-pressure feedwater (HPFW) train was ~28 ppb below the minimum required reading of 30 ppb (EPRI action level 1). Dissolved oxygen measured from the A HPFW train and condensate demineralizer effluent (CDE) were acceptable (~ 70 to 80 ppb). The root cause was B HPFW sample line contamination, not actually low oxygen in the feedwater. The B HPFW sample line was replaced.

(2) On October 28, 2002, HPFW and CDE dissolved oxygen levels spiked to 400 to 500 ppb for about 15 minutes before returning to normal. EPRI action level 1 for HPFW dissolved oxygen is 200 ppb. The root cause was inadequate filling of the D demineralizer prior to its return to service. The procedure states, "It is EXTREMELY important that all air is vented from a Cond Demin before it is placed in service to prevent air injection into the Feedwater System." Procedural steps were emphasized for proper venting to mitigate elevated oxygen levels in the feedwater system.

The applicant further stated that continuous confirmation of water quality and timely corrective action provide evidence that the program effectively manages component aging effects. QA audits in 2000 and 2002 revealed no issues or findings with impact on program effectiveness. A QA audit in 2004 revealed that reactor coolant sodium and lithium analyses had not been weekly during the first half of 2004. The applicant took corrective action to replace the analysis instrument and to complete the analyses as required. A corporate assessment in 2003 found areas for improvement in administrative controls but no issues or findings with impact on program effectiveness.

The staff also reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.37, the applicant provided the UFSAR supplement for the Water Chemistry Control - BWR Program. The staff reviewed this section and determined 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 audit and review of the applicant's Water Chemistry Control - BWR Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2 AMPs That Are Consistent with the GALL Report with Exceptions and/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:

- Buried Piping and Tanks Inspection Program
- BWR CRD Return Line Nozzle Program
- BWR Feedwater Nozzle Program
- BWR Penetrations Program
- BWR Stress Corrosion Cracking Program
- BWR Vessel ID Attachment Welds Program
- BWR Vessels Internals Program
- Diesel Fuel Monitoring Program
- Fatigue Monitoring Program
- Fire Protection Program
- Fire Water System Program
- Metal-Enclosed Bus Inspection Program
- Oil Analysis Program
- Reactor Head Closure Studs Program
- Reactor Vessel Surveillance Program
- Service Water Integrity Program
- Structures Monitoring Program
- Water Control Structures Monitoring Program
- Water Chemistry Control - Closed Cooling Water 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 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 Buried Piping and Tanks Inspection Program

Summary of Technical Information in the Application. LRA Section B.1.2, "Buried Piping and Tanks Inspection," describes the new Buried Piping and Tanks Inspection Program as consistent, with exception, with GALL AMP XI.M34, "Buried Piping and Tanks Inspection."

This program includes (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel, stainless steel, and titanium components. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. Buried components are inspected when excavated during maintenance. There will be a focused inspection within the first 10 years of the period of extended operation unless an opportunistic inspection (or an inspection via a method that assesses pipe condition without excavation) occurs within this ten-year period.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.1. The staff reviewed the exception to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the Buried Piping and Tanks Inspection Program for which the applicant claims consistency with GALL AMP XI.M34 and finds them consistent. Furthermore, the staff concludes that the applicant's Buried Piping and Tanks Inspection Program provides reasonable assurance of management of the effects of aging so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Buried Piping and Tanks Inspection Program acceptable as consistent with the recommended GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with the exceptions as described:

Exception. The LRA states an exception to the GALL Report program element "detection of aging effects," specifically:

> For cases of excavation solely for the purpose of inspection – methods such as "phased array" UT will be used to determine wall thickness without excavating.

The proposed exception eliminates the possibility of inadvertent excavation related damage during inspection while assessing the component. As the technology becomes available for the nuclear industry, applicants may use this technology to examine the condition of buried piping. On this basis, the staff finds this exception acceptable.

Operating Experience. LRA Section B.1.2 states that there is no operating experience for the new Buried Piping and Tanks Inspection Program.

However, in the past five years, the applicant has had limited experience with the inspection of buried piping, mainly on the fire water underground distribution system. This system, approximately 35 years old, consists of cement-lined malleable iron pipe with mechanical joints and no history of significant leaks other than during two instances in 2001 and 2005. In the first, the 8-inch underground line downstream of 8-L-22 failed, the probable cause induced most likely by minor fabrication anomalies compounded by marginal installation techniques. When examined, this piping was found to be in very good external condition overall except for a small area of surface corrosion attributed to marginal installation techniques. In the second instance, the 8-inch underground pipe failed in the area of the N2 tank adjacent to the emergency diesel generator (EDG) building. Due to congestion and the presence of the tank (installed after the piping), it was not possible to dig up the piping for examination to determine the cause of the failure (possibly related to the tank installation). Apart from these two instances, a number of valves and piping excavated during maintenance were found to be in good condition.

From an additional historical perspective, the SSW system has had leaks on the buried inlet (screenhouse to auxiliary bays) piping due to internal corrosion. The original piping material was rubber-lined carbon steel wrapped with reinforced fiberglass, coal tar saturated felt, and heavy Kraft paper. The leaks were determined to be results of the rubber lining degrading from contact with sea water. These pipes were replaced in 1995 and 1997 with the same external and internal coatings as for the original pipe.

In addition, the SSW buried discharge piping (also rubber-lined carbon steel with external pipe wrapping) from the auxiliary bays to the discharge canal experienced severe internal corrosion due to failure of the rubber lining. Two 40-foot lengths of 22-inch diameter pipes (one on each loop) were replaced in 1999 with carbon steel coated internally and externally with epoxy. The replaced piping was examined with its wrapping removed and its external surface was found to be in good condition. Since then, the entire length of both SSW buried discharge loops have been lined internally with pipe linings cured in place – "B" Loop in 2001 and "A" Loop in 2003.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.2, the applicant provided the UFSAR supplement for the Buried Piping and Tanks Inspection Program. The staff reviewed this section and determined that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The LRA states that this program will be implemented before the period of extended operation (Commitment No. 1).

Conclusion. On the basis of its audit and review of the applicant's Buried Piping and Tanks Inspection Program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 BWR CRD Return Line Nozzle Program

Summary of Technical Information in the Application. LRA Section B.1.3, "BWR CRD Return Line Nozzle," describes the existing BWR CRD Return Line Nozzle Program as consistent, with exceptions, with GALL AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle."

Under this program, the applicant has cut and capped the CRD return line nozzle to mitigate cracking and continued ISI examinations to monitor the effects of crack initiation and growth on intended functions of the CRD return line nozzle and cap. In 2003, a structural weld overlay was installed over a crack in the CRD return line nozzle-to-cap weld. The Inconel 52 weld metal in the overlay is highly resistant to stress corrosion cracking (SCC).

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.2. The staff reviewed the exceptions to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the BWR Control Rod Drive Return Line Nozzle Program for which the applicant claims consistency with GALL AMP XI.M6 and found them consistent. Furthermore, the staff concludes that the applicant's BWR Control Rod Drive Return Line Nozzle Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's BWR Control Rod Drive Return Line Nozzle Program acceptable as consistent with the recommended GALL AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle," with the exceptions as described:

Exception 1. The applicant examines ½ inch of the volume next to the widest part of the N10 nozzle-to-vessel weld rather than half of the vessel wall thickness.

The LRA states that extending the examination volume into the base metal, as required by ASME Code Section XI, 1998 Edition, 2000 Addenda, Figure IWB-2500-7(b) prolongs the examination time significantly with no net increase in safety. The extra volume is base metal region which is not prone to inservice cracking and has been extensively examined before the vessel is put into service and during the first, second, and third interval examinations.

In RAI B.1.3-2 dated July 31, 2006, the staff submitted to the applicant a request that the applicant provide justification for taking this exception.

In its response dated August 30, 2006, the applicant stated that ASME Code Case N-613-1, "Ultrasonic Examination of Full Penetration Nozzles in Vessels," has been accepted by the staff and is included in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1."

In a letter dated September 13, 2006, the applicant revised LRA Section B.1.3 to remove the exception to the "parameters monitored/inspected" program element for inspection volume. This reduction of examination volume for the adjacent base metal is now in accordance with ASME Code Case N-613-1 approved by the NRC in Regulatory Guide (RG) 1.147, Revision 14, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1."

The staff identified that the GALL AMP XI.M6 does not specify Code Case N-613-1 making the basis for deleting this Exception invalid. The staff determined that the use of this code case is technically acceptable since it has been included in Regulatory Guide 1.147 as a staff endorsed code case, but the applicant should reinstate this exception to LRA Section B.1.3.

In a conference call dated December 12, 2006, the applicant agreed to reinstate Exception 1 in the LRA Section B.1.3. In a letter dated January 16, 2007, the applicant reinstated this exception to LRA Section B.1.3. Therefore, the staff's concern described in RAI B.1.3-2 is resolved.

Exception 2. The LRA states an exception to the GALL Report program elements "detection of aging effects" and "monitoring and trending," specifically:

> The extent and schedule of inspection, as delineated in NUREG 0619, are not followed. Specifically, liquid penetrant testing (PT) of control rod drive return line (CRDRL) nozzle blend radius and bore regions is not performed.

The LRA states that the weld overlay in a crack in the CRD return line nozzle-to-cap weld covers the nozzle, the nozzle-to-cap weld, and part of the cap. The Inconel 52 weld overlay, highly resistant to SCC, is inspected ultrasonically in accordance with Generic Letter (GL) 88-01 and BWRVIP-75. The weld overlay provides reasonable assurance of structural and pressure boundary integrity of the reactor pressure vessel (RPV) capped N10 nozzle and, thus, an acceptable level of quality and safety. As the nozzle and original nozzle-to-cap weld are covered by the examined overlay, examination of the nozzle and original nozzle-to-cap weld is not required.

The CRD return line nozzle N-10 weld overlay repair will continue to be inspected under the Inservice Inspection Program as a Category E weld in accordance with BWRVIP-75-A, "Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules," during the period of extended operation. The staff finds this exception to these elements acceptable because the BWRVIP was accepted by the staff on May 14, 2002.

Exception 3. The LRA states an exception to the GALL Report program element "acceptance criteria," specifically:

> PNPS repaired the CRDRL nozzle by weld overlay rather than removing the crack by grinding and examines the overlay using UT in lieu of RT.

The LRA states that in a letter dated February 25, 2005, the staff concluded that the proposed alternative provides reasonable assurance of structural and pressure boundary integrity of the RPV capped N10 nozzle and, thus, an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorized the use of ASME Code Case N-504-2, as modified, and the use of UT in lieu of radiography for a weld overlay repair of the CRD return line nozzle-to-cap weld (N10).

The staff asked the applicant for the basis for use of the weld overlay. The applicant stated that a relief request submitted to the NRC for use of ASME Code Case N -504-2 for the CRD return line weld overlay received NRC approval before startup of the N10 nozzle repair outage. The applicant requested alloys 152/52 for the weld overlay repair material and an alternate inspection plan in lieu of the hydrostatic pressure test.

The CRD return line nozzle weld overlay repair was designed and installed in accordance with the 1989 Edition of ASME Code Section XI. Nonmandatory Appendix Q of ASME Code Section XI, published first as part of the 2004 Edition, therefore was not considered for the CRD return line nozzle weld overlay modification.

The CRD return line nozzle N10 weld overlay repair will continue to be inspected under the Inservice Inspection Program as a category E weld in accordance with BWRVIP-71-A during the period of extended operation.

In a letter dated February 25, 2005, the staff concluded that the proposed alternative provides reasonable assurance of structural and pressure boundary integrity of the capped N10 nozzle and, thus, an acceptable level of quality and safety. The staff also approved the use of UT in lieu of RT for overlay inspection. Moreover, Code Case N -504-2 has been endorsed by the staff and included in RG 1.147, Revision 14.

On the basis of the prior approval of the code case included in RG 1.147, Revision 14, and the use of UT in place of RT the staff finds this exception acceptable.

Operating Experience. LRA Section B.1.3 states that on October 1, 2003, a planned visual inspection of the drywell detected a reactor coolant pressure boundary leak from the N10 nozzle-to-cap weld area. Through-wall leakage from the N10 nozzle-to-cap butt weld was caused by an incipient crack or crevice remaining in the weld after repair as part of the 1977 nozzle-to-cap fabrication welding. Following the repair, crack propagation continued through-wall by an inter-dendritic SCC mechanism due to high residual weld stresses in the Inconel 82/182 weld metal. A structural weld overlay was installed with Inconel 52 weld metal, which is highly resistant to stress corrosion cracking. The weld overlay process also imparts a compressive residual stress which prevents further crack growth.

The N10 nozzle-to-cap weld received all code-required pre-service NDEs and was pressure-tested prior to its return to service. Ultrasonic examinations can detect incipient cracking from SCC mechanisms and flaws entirely within the weld metal and would have detected weld cracking. As the weld overlay is highly resistant to cracking and will be examined as required, the BWR CRD Return Line Nozzle Program remains effective for managing the effect of cracking on the CRD return line nozzle intended function.

The CRD return line nozzle N10 weld overlay repair will be inspected under the Inservice Inspection Program as a category E weld in accordance with BWRVIP-75-A, "Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules," during the period of extended operation.

The applicant commits (Commitment No. 30) to a code repair of the CRD return-nozzle-to-cap weld as needed per accepted code cases, revised codes, or subsequent approval of relief requests if the installed overlay weld repair is not approved.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.3, the applicant provided the UFSAR supplement for the BWR CRD Return Line Nozzle Program. In a letter dated September 13, 2006, the applicant revised LRA Section A.2.1.3, "BWR CRD Return Line Nozzle Program," to include Commitment No. 30.

The staff reviewed this section and determined 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 audit and review of the applicant's BWR CRD Return Line Nozzle Program, the staff that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 BWR Feedwater Nozzle Program

Summary of Technical Information in the Application. LRA Section B.1.4, "BWR Feedwater Nozzle," describes the existing BWR Feedwater Nozzle Program as consistent, with exceptions, with GALL AMP XI.M5, "BWR Feedwater Nozzle."

Under this program, the applicant has removed feedwater blend radii flaws and feedwater nozzle cladding and installed a triple-sleeve, double-piston sparger to mitigate cracking. This program continues enhanced ISI of the feedwater nozzles as required by ASME Code Section XI, Subsection IWB and the recommended in General Electric (GE) NE-523-A71-0594 to monitor the effects of cracking on the intended function of the feedwater nozzles.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.3. The staff reviewed the exceptions to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the BWR Feedwater Nozzle Program for which the applicant claims consistency with GALL AMP XI.M5 and found them consistent. Furthermore, the staff concludes that the applicant's BWR Feedwater Nozzle Program provides reasonable assurance that the effects of aging will be managed so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's BWR Feedwater Nozzle Program acceptable as consistent with the recommended GALL AMP XI.M5, "BWR Feedwater Nozzle," with the exceptions as described:

Exception 1. The LRA states an exception to the GALL Report program element "preventive actions," specifically:

> A low-flow controller was not installed, and the reactor water cleanup system was not rerouted.

The LRA states that in its safety evaluation of BWR feedwater and CRD return line modifications the staff noted that the modifications had satisfied the intent of NUREG-0619 and NEDE-21821-A requirements. Since the removal of the stainless steel cladding and the installation of improved spargers the margin of safety against feedwater nozzle crack growth has been adequate; therefore, the staff concluded that, with continued inspections to monitor for crack initiation and growth, PNPS can operate without rerouting the reactor water cleanup system and without installing a low-flow controller for the feedwater system. With continued inspections to monitor for crack initiation and growth, this conclusion remains valid for the period of extended operation.

The staff reviewed the relevant documents and agreed that the previous staff conclusions remain valid for the period of extended operation. On this basis, the staff finds this exception acceptable.

Exception 2. The LRA states an exception to the GALL Report program element "parameters monitored and inspected," specifically:

> The applicant reduced the examination volume next to the widest part of the feedwater nozzle-to-vessel welds from half the vessel wall thickness to ½ inch.

The LRA states that extending the examination volume into the base metal as required by ASME Code Section XI, 1998 Edition, 2000 Addenda, Figure IWB-2500-7(b), prolongs the examination time significantly with no net increase in safety. The extra volume is base metal not prone to inservice cracking and extensively examined before the vessel was put into service and during the first, second, and third interval examinations.

The staff questioned the regulatory basis for reducing the examination volume. The applicant replied that the reduced volume is in accordance with ASME Code Case N-613-1 endorsed by the staff in RG 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." On this basis, the use of endorsed code cases acceptable to the NRC staff, the staff finds this exception acceptable.

Operating Experience. LRA Section B.1.4 states that in October 1989, after discovering that feedwater nozzles had not been examined with scans designed for the bore, the applicant revised procedures and subsequent examinations were in accordance with NUREG-0619. As feedwater nozzle bores examined subsequently had no recordable indications and will be examined as required, this program error did not impact the ability of the BWR Feedwater Nozzle Program to manage the effect of cracking on the feedwater nozzle intended function. UT of the feedwater nozzles during RFO 14 (April 2003) found no recordable indications. The LRA states that the absence of recordable indications on the feedwater nozzles provides evidence that the program effectively manages cracking of the nozzles.

The staff did not agree with the applicant that the absence of recordable indications on the feedwater nozzles provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of cracking.

The staff reviewed the operating experience presented in the LRA and determined that this program does not manage cracking of the nozzles and piping, rather it is used to monitor the stainless steel reactor coolant nozzles and piping using ASME Code Section XI, Appendix VIII qualified procedures and operators. Using a qualified procedure and qualified operator will ensure that recordable indications will be detected during future UT inspections. In addition, the staff interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.4, the applicant provided the UFSAR supplement for the BWR Feedwater Nozzle Program. The staff reviewed this section and determined 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 audit and review of the applicant's BWR Feedwater Nozzle Program, the staff that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 BWR Penetrations Program

Summary of Technical Information in the Application. LRA Section B.1.5, "BWR Penetrations," describes the existing BWR Penetrations Program as consistent, with exceptions, with GALL AMP XI.M8, "BWR Penetrations."

The program includes (a) inspection and flaw evaluation in compliance with the guidelines of staff-approved BWRVIP documents BWRVIP-27 and BWRVIP-49 and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure long-term integrity of vessel penetrations and nozzles.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.4. The staff reviewed the exceptions to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the BWR Penetrations Program for which the applicant claims consistency with GALL AMP XI.M8 and found them consistent. Furthermore, the staff concludes that the applicant's BWR Penetrations Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's BWR Penetrations Program acceptable as consistent with the recommended GALL AMP XI.M8, "BWR Penetrations," with the exceptions described:

Exception 1. The LRA states an exception to the GALL Report program elements "scope of program," "parameters monitored/inspected," and "detection of aging effects," specifically:

> Surface examinations are not performed on instrument penetration nozzle welds. In accordance with ASME Code Section XI, Code Case N-578 for elements classified as low risk, inspections to monitor the effects of cracking on the intended function of instrument penetration nozzles (N15A/B and N16A/B) include enhanced visual (VT-2 with insulation removed) examinations during system pressure testing. Also, a UT exam of the N16B safe end-to-reducer weld is performed once every 10 years. However, ASME Code Section XI, Table IWB-2500-1, and BWRVIP-49 (by reference) also recommend surface examinations.

The LRA states that the applicant has implemented risk-informed ISI (RI-ISI) in accordance with ASME Code Section XI, Code Case N-578, and that RI-ISI reduces overall risk to the plant because the process concentrates on welds with the greatest risk of potential degradation and failure. The applicant's note stated that, in addition, RI-ISI examinations focus on examination volumes where flaws are most likely and captures risk better than ASME Code Section XI requirements which are based on design stresses and random selection. The applicant's note also stated that the original IGSCC-susceptible 304 stainless steel safe end extensions for the N15 and N16 nozzles had been replaced with more IGSCC-resistant material.

During the audit and review, the staff asked the applicant to clarify which vessel penetration nozzles are included in the BWR Penetrations Program and whether these are the only RPV instrument penetrations.

In response, the applicant stated that there are five RPV penetration nozzles in the program, instrument penetrations N15A/B and N16A/B, and standby liquid control (SLC)/core plate differential pressure instrument penetration N14, and that these are the only instrument partial-penetration weld nozzles.

The staff reviewed the piping and instrumentation drawings for nuclear boiler vessel instrumentation together with portions of BWRVIP-27 and BWRVIP-49 and confirmed that the five penetrations stated by the applicant are the only penetrations recommended by the GALL Report as within the scope of the BWR Penetrations Program.

The staff noted that, although approved for the fourth 10-year ISI interval, RI-ISI has not been accepted for aging management during the period of extended operation. The staff asked the applicant for more justification of why its BWR Penetrations Program, with the exception, is adequate to manage the aging of the RPV instrument nozzles during the period of extended operation.

In response, the applicant stated that for the instrument nozzles the aging effect of cracking is managed by a combination of the BWR Water Chemistry Program and the BWR Penetrations Program and that the combination of mitigation and inspections is adequate aging management for penetrations during the period of extended operation for the following reasons:

> ASME Section XI, Subsection IWB-2500, without exclusions, requires a surface examination of these components. However, because the aging effect of interest

originates on the inside diameter wall (exposed to treated water >140 deg-F), these surface examinations would only detect a flaw after the flaw propagated thru-wall. The surface examinations would not detect any flaws that are not thru-wall.

The PNPS ISI program includes inspection of welds of the same material/environment combinations as the welds within the BWR Penetrations Program. These inspections will provide information on the aging of the subject components. If any indications are found on the similar component inspections (same material/environment combination), sample expansions will lead to more similar locations and, if appropriate, to the actual components in question. Inspection of representative sample locations is acceptable to confirm the aging of the components' material/environment combination.

PNPS performs an enhanced VT-2 of these penetrations that is in excess of both code requirements and the recommendations of BWRVIP-27 and BWRVIP-49, which specify a VT-2 examination for these penetrations. The enhancement is that the insulation is removed from the penetrations so that the penetration and welds are viewed directly and specifically during the system leak test performed after each RFO, ensuring the detection of even very small amounts of leakage from these penetrations. PNPS will continue to follow BWRVIP-27 and BWRVIP-49 guidelines during the period of extended operation, including VT-2 examinations in excess of code requirements for the N15A/B, N16A/B and N14 penetrations. PNPS believes this is the most effective way to monitor the condition of these specific components. Given the code surface exams will only detect through wall failures from the ID, these enhanced VT-2 examinations will find the same thru-wall flaws that the surface exams would find.

The applicant responded that (1) all required penetrations are included within the scope of its BWR Penetrations Program; (2) aging management of penetrations is by the BWR Water Chemistry Program and the BWR Penetrations Program, plus examination of other components with the same materials and environments by the Inservice Inspection Program; and (3) it will continue to follow BWRVIP-27 and BWRVIP-49 guidelines during the period of extended operation, including enhanced VT-2 examinations in excess of code requirements.

The staff determined that the applicant's BWR Penetrations Program includes appropriate components within its scope for both mitigation of aging effects and examinations to confirm the effectiveness of the mitigation during the period of extended operation. On this basis, the staff finds this exception acceptable.

Exception 2. The LRA states an exception to the GALL Report program element "parameters monitored/inspected," specifically:

Table IWB-2500-1 from the 1998 Edition with 2000 Addenda of ASME Code Section XI is used, while the GALL Report specifies the 2001 Edition with 2002 and 2003 Addenda.

The LRA states that, because ASME Code Section XI through the 2003 Addenda has been accepted by reference in 10 CFR 50.55a(b)(2) without modification or limitation on use of

Table IWB-2500-1 from the 1998 Edition with 2000 Addenda for BWR components, use of this version is appropriate assurance that components crediting this program can perform intended functions consistent with the CLB during the period of extended operation.

The staff noted that ASME Code Section XI edition and addenda cited in Exception 2 is the code of record for the applicant's ASME Code Section XI Fourth 10-Year Interval Inservice Inspection Program Plan and that the applicant's fourth 10-year ISI interval extends approximately three years into the period of extended operation.

On the basis that Exception 2 is consistent with the applicant's current ASME Code Section XI code of record for ISI and that the ASME Code Section XI code edition and addenda to which the GALL Report refers was accepted without modification or limitation on use of Table IWB-2500-1 from the 1998 edition with 2000 addenda for BWR components, the staff finds the applicant's use of the earlier code edition/addenda satisfactory and this exception acceptable.

Operating Experience. LRA Section B.1.5 states that in January 2005 the applicant found three 2½-inch piping butt welds in SLC system piping adjacent to nozzle N14 not shown on inspection drawings and not included in ISI weld totals. Two (RPV-N14-T1 and RPV-N14-T2) are shop welds in a vendor-supplied tee. The third (RPV-14-2) is the connection field weld between the tee and the SLC nozzle (N14) safe end extension piece included in RFO 11 surface examinations of the N14 nozzle safe end weld and safe end extension piece. Corrective actions during RFO 15 added the welds to ISI weld totals and examined the nozzle surface of weld RPV-N14-2. As RPV-N14-2 has been examined without recordable indications and will continue to be examined as required, this program error had no impact on the ability of the BWR Penetrations Program to manage the effect of cracking on the SLC nozzle intended function.

Inservice examination of the SLC nozzle, (including weld RPV-N14-2 as described) during RFO 15 (April 2005) revealed no recordable indications. The LRA states that the absence of recordable indications on the SLC nozzle and adjacent welds provides evidence that the program effectively manages cracking of the nozzle.

Liquid penetrant examination of instrument penetration nozzle N15A in 1990 revealed no recordable indications. The LRA states that the absence of recordable indications provides evidence that the program effectively manages cracking of the instrument penetration nozzles.

Inservice examination of instrument penetration nozzles during RFO 15 (April 2005) revealed no recordable indications. The LRA states that the absence of recordable indications provides evidence that the program effectively manages cracking of the nozzles.

The staff did not agree with the applicant that the absence of recordable indications provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of cracking.

The staff reviewed the operating experience presented in the LRA and determined that this program does not manage cracking of the nozzles and piping, rather it is used to monitor the stainless steel reactor coolant nozzles and piping using ASME Code Section XI, Appendix VIII qualified procedures and operators. Using a qualified procedure and qualified operator will ensure that recordable indications will be detected during future UT inspections. In addition, the staff requested the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.5, the applicant provided the UFSAR supplement for the BWR Penetrations Program. The staff reviewed this section and determined 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 audit and review of the applicant's BWR Penetrations Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 BWR Stress Corrosion Cracking Program

Summary of Technical Information in the Application. LRA Section B.1.6, "BWR Stress Corrosion Cracking," describes the existing BWR Stress Corrosion Cracking Program as consistent, with exception and enhancement, with GALL AMP XI.M7, "BWR Stress Corrosion Cracking."

The program includes (a) preventive measures to mitigate IGSCC and (b) inspection and flaw evaluation to monitor IGSCC effects on reactor coolant pressure boundary components made of stainless steel or CASS.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.5. The staff reviewed the exception and enhancement to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed portions of the BWR Stress Corrosion Cracking Program for which the applicant claims consistency with GALL AMP XI.M7 and found them consistent. Furthermore, the staff concludes that the applicant's BWR Stress Corrosion Cracking Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's BWR Stress Corrosion Cracking Program acceptable as consistent with the recommended GALL AMP XI.M7, "BWR Stress Corrosion Cracking," with the exception and enhancement as described:

Exception. The LRA states an exception to the GALL Report program element "acceptance criteria," specifically:

> The 1998 Edition with 2000 Addenda of ASME Code Section XI, Subsection IWB-3600, is used for flaw evaluation, while the GALL Report specifies the 1986 Edition of ASME Code Section XI, Subsection IWB-3600, for flaw evaluation.

The LRA states that, because ASME Code Section XI through the 2003 Addenda has been accepted by the NRC in 10 CFR 50.55a(b)(2) without modification or limitation on use of Subsection IWB-3600 from the 1998 Edition with 2000 Addenda, use of this version for flaw evaluation is appropriate assurance that components crediting this program can perform intended functions consistent with the CLB during the period of extended operation.

During the audit and review, the staff asked the applicant to specify which paragraphs of Subsection IWB-3600, "Analytical Evaluation of Flaws," in the 1986 Edition of ASME Code Section XI cited in the GALL Report differ in the 1998 Edition with 2000 Addenda of ASME Code Section XI used by the applicant's program.

The applicant responded with a comparison table listing the Subsection IWB-3600 differences in the ASME Code Section XI editions. The staff reviewed the applicant's response together with GL 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," issued January 25, 1988, and GL 88-01, Supplement 1, issued February 4, 1992.

On the basis of this review, the staff determined that the reference to the 1986 Code Edition in GL 88-01 is to the approved ASME Code Section XI edition at the time that GL 88-01 was issued and that neither the original GL nor its later supplement requires analytical evaluation of flaws in accordance with only the 1986 Code Edition and not a later edition accepted by the NRC. Because ASME Code Section XI, 1998 Edition with 2000 Addenda, has been accepted without modification or limitation on use of Subsection IWB-3600, the staff determined that the applicant's use of it for analytical evaluation of flaws is acceptable. On this basis, the staff finds the exception acceptable.

Enhancement. The LRA states an enhancement to the GALL Report program element "monitoring and trending," specifically:

> The implementing procedure for ASME Code Section XI ISI and testing will be enhanced to specify that the guidelines of NRC GL 88-01 or approved BWRVIP-75 shall be considered in determining sample expansion if indications are found in NRC GL 88-01 welds.

The LRA states that this enhancement will start before the period of extended operation (Commitment No. 2).

During the audit and review, the staff observed that the LRA states that this and other enhancements will be "initiated" before the period of extended operation. The staff noted that, as "initiated" rather than "implemented," the LRA wording is ambiguous as to whether the enhancement will be implemented fully before the period of extended operation. The staff asked the applicant to clarify or resolve this ambiguity in the LRA.

In its response dated September 13, 2006, the applicant stated the intent that enhancements will be implemented fully before the period of extended operation.

As the applicant's response provided the clarification requested, the staff finds it acceptable.

During the audit and review, the staff asked the applicant to clarify its current basis for determining sample expansion if indications are found in GL 88-01 welds.

The applicant responded with the following information:

> If cracking is determined in NRC GL 88-01 Category A welds, the scope expansion rules of the PNPS Risk-Informed Inservice Inspection Program in accordance with EPRI Topical Report TR-112657 will be used to determine scope expansion size and content. Scope expansion caused by cracking detected in any other GL 88-01 category (B through G) will be determined by the scope expansion criteria of BWRVIP-75A used in conjunction with NRC GL 88-01.

Because the applicant uses appropriate bases for determining sample expansion if indications are found in GL 88-01 welds, the staff finds the response acceptable.

The staff reviewed the applicant's evaluation of the "monitoring and trending" element of its current BWR Stress Corrosion Cracking Program documented in the AMPER, which stated that the applicable section of its implementing procedure for ASME Code ISI and inservice testing would be enhanced to specify that the guidelines in GL 88-01 or approved BWRVIP-75 shall be considered in determining sample expansions if indications are found in GL 88-01 welds. The staff reviewed the applicable implementing procedure section and found that it states that PNPS design engineering will determine sample expansion if ASME Code Section XI does not specify the expansion sample; the current procedure does not refer specifically to GL 88-01 or BWRVIP-75 requirements.

On the basis that the GALL Report states that GL 88-01 or BWRVIP-75 provides guidelines for additional weld sample inspections when one or more cracked welds are found in a weld category, the staff determined that the applicant's enhancement to add references to GL 88-01 and BWRVIP-75 into the implementing procedure to bring the current program into compliance with the GALL Report recommendations is acceptable.

Operating Experience. LRA Section B.1.6 states that ultrasonic examinations during RFO 14 (April 2003) of GL 88-01 nozzle safe end welds and austenitic stainless steel reactor coolant piping with 4-inch and greater nominal diameter and operating temperature greater than 200 °F revealed no recordable indications. The LRA states that the absence of recordable indications on the nozzles and piping provides evidence that the program effectively manages cracking of austenitic stainless steel components. Further, ultrasonic examinations during RFO 15 (April 2005) of nozzle safe end welds and austenitic stainless steel reactor coolant piping with 4-inch and greater nominal diameter and operating temperature greater than 200°F revealed no recordable indications. The LRA states that the absence of recordable indications provides evidence that the program effectively manages cracking of the nozzles and piping.

The staff did not agree with the applicant that the absence of recordable indications provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of cracking.

The staff reviewed the operating experience presented in the LRA and determined that this program does not manage cracking of the nozzles and piping, rather it is used to monitor the stainless steel reactor coolant nozzles and piping using ASME Code Section XI, Appendix VIII qualified procedures and operators. Using a qualified procedure and qualified operator will ensure that recordable indications will be detected during future UT inspections. In addition, the staff interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.6, the applicant provided the UFSAR supplement for the BWR Stress Corrosion Cracking Program. During the audit and review, the staff noted that the applicant's description of the program in the UFSAR supplement in LRA Appendix A did not include, as a commitment, the enhancement described in LRA Section B.1.6, "BWR Stress Corrosion Cracking." The staff asked the applicant to include a description of the enhancement to the BWR Stress Corrosion Cracking Program in the LRA Appendix A UFSAR supplement.

In its response dated September 13, 2006, the applicant revised LRA Section A.2.1.6, "BWR Stress Corrosion Cracking Program," to include Commitment No. 2.

The staff reviewed this section and determined 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 audit and review of the applicant's BWR Stress Corrosion Cracking Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. Also, the staff reviewed the enhancement and confirmed that implementation prior to the period of extended operation would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 BWR Vessel ID Attachment Welds Program

Summary of Technical Information in the Application. LRA Section B.1.7, "BWR Vessel ID Attachment Welds," describes the existing BWR Vessel ID Attachment Welds Program as consistent, with exception, with GALL AMP XI.M4, "BWR Vessel ID Attachment Welds."

The program includes (a) inspection and flaw evaluation in accordance with the guidelines of staff-approved BWRVIP-48 and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 (EPRI Report 1008192) to ensure the long-term integrity and safe operation of reactor vessel inside diameter attachment welds and support pads.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.6. The staff reviewed the exception to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the BWR Vessel ID Attachment Welds Program for which the applicant claims consistency with GALL AMP XI.M4 and found them consistent. Furthermore, the staff concludes that the applicant's BWR Vessel ID Attachment Welds Program reasonably assures management of aging effects so applicable components will continue to perform intended functions consistent with the CLB for the period of extended operation. The staff finds the applicant's BWR Vessel ID Attachment Welds Program acceptable as consistent with the recommended GALL AMP XI.M4, "BWR Vessel ID Attachment Welds," with the exception described:

Exception. The LRA states an exception to the GALL Report program element "parameters monitored/inspected," specifically:

> Table IWB-2500-1 from the 1998 Edition with 2000 Addenda of ASME Code Section XI is used, while the GALL Report specifies the 2001 Edition with 2002 and 2003 Addenda.

The LRA states that, because ASME Code Section XI through the 2003 Addenda has been accepted by reference in 10 CFR 50.55a(b)(2) without modification or limitation on use of Table IWB-2500-1 from the 1998 Edition with 2000 Addenda for BWR components, this version is appropriate assurance that components crediting this program can perform intended functions consistent with the CLB during the period of extended operation.

During the audit and review, the staff asked the applicant to confirm that it inspects vessel inner diameter (ID) attachment welds stringently as recommended in BWRVIP-48 and described in the GALL AMP XI.M4, "BWR Vessel ID Attachment Welds Program," "detection of aging effects" program element. The staff also asked the applicant for a list of the Category B-N-2 vessel ID attachment welds inspected by the more stringent enhanced VT-1 examination techniques. The applicant responded to these requests with the following information:

> PNPS follows the requirement of BWRVIP-48 as approved by the NRC for inspections. The components that are inspected using the enhanced VT-1 techniques recommended in BWRVIP-48 are (1) jet pump riser brace – primary brace attachments, (2) core spray piping – primary bracket attachments, (3) steam dryer support brackets, and (4) feedwater bracket attachments.

The staff reviewed the applicant's response together with the inspection recommendations in BWRVIP-48 and determined that the attachment welds listed by the applicant as subject to the enhanced VT-1 examination technique are the same welds for which the modified ("enhanced") VT-1 examination technique is recommended in BWRVIP-48, Table 3-2, "Bracket Attachment Inspection Recommendations." Based on consistency between the components listed in the applicant's response and those listed in BWRVIP-48, the staff finds the applicant's response acceptable.

During the audit and review, the staff asked the applicant to confirm that the BWR Vessel ID Attachment Welds Program implements the evaluation guidelines of BWRVIP-14, BWRVIP-59, and BWRVIP-60 listed in the GALL Report description of the "acceptance criteria" program element for the BWR Vessel ID Attachment Welds Program.

The applicant responded with the following statement:

> PNPS plant procedures require that flaws be evaluated in accordance with BWRVIP Inspection and Flaw Evaluation Guidelines for components that perform a safety function. Subsequent BWRVIP correspondence that has been approved by the BWRVIP Executive Committee must also be considered when evaluating flaws. For components that do not perform a safety function, flaw evaluation shall be established by Design Engineering using the Condition Report process. Any flaw evaluation done by PNPS would consider all pertinent information available at that time, including the three BWRVIP documents listed in the GALL Report, Section XI.M4.

Because the flaw evaluation process includes the BWRVIP evaluation guidelines recommended in the GALL Report, the staff finds the applicant's response acceptable.

The staff reviewed the applicant's responses together with the applicant's fourth 10-year ISI program plan (ADAMS Accession Number ML051920157) and confirmed that the applicant's use of ASME Code Section XI, 1998 Edition with 2000 Addenda, as the basis for its BWR Vessel ID Attachment Welds Program is consistent with its fourth 10-year inspection program plan. The staff also determined from the applicant's responses that the BWR Vessel ID Attachment Welds Program is consistent for other program elements with recommendations of the GALL Report and the BWRVIP reports to which it refers. On this basis, the staff finds this exception acceptable.

<u>Operating Experience</u>. LRA Section B.1.7 states that visual and enhanced visual examinations of vessel attachment welds (feedwater bracket attachment and jet pump riser braces) during RFO 14 (April 2003), like previous visual and enhanced visual examinations, revealed no recordable indications. The LRA states that the absence of recordable indications on the vessel attachment welds provides evidence that the program effectively manages cracking of the welds.

Visual and enhanced visual examinations of vessel attachment welds (core spray piping bracket, guide rod bracket attachment, steam dryer support brackets, steam dryer hold-down brackets, and surveillance specimen holder brackets) during RFO 15 (April 2005) revealed no recordable indications. The LRA states that the absence of recordable indications provides evidence that the program effectively manages cracking of the welds.

The staff did not agree with the applicant that the absence of recordable indications provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of cracking.

The staff reviewed the operating experience presented in the LRA and determined that this program does not manage cracking of the nozzles and piping, rather it is used to monitor the stainless steel reactor coolant nozzles and piping using ASME Code Section XI, Appendix VIII qualified procedures and operators. Using a qualified procedure and qualified operator will ensure that recordable indications will be detected during future UT inspections. In addition, the staff interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.7, the applicant provided the UFSAR supplement for the BWR Vessel ID Attachment Welds Program. The staff reviewed this section and determined 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 audit and review of the applicant's BWR Vessel ID Attachment Welds Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 BWR Vessels Internals Program

Summary of Technical Information in the Application. LRA Section B.1.8, "BWR Vessels Internals," describes the existing BWR Vessels Internals Program as consistent, with exceptions and enhancement, with GALL AMP XI.M9, "BWR Vessel Internals."

The program includes (a) inspection, flaw evaluation, and repair according to applicable, staff-approved BWRVIP documents and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 for long-term integrity of vessel internals components.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.7. The staff reviewed the exceptions and enhancement to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the BWR Vessel Internals Program for which the applicant claimed consistency with GALL AMP XI.M9 and found them consistent. The staff also reviewed the response to BWRVIP applicant action items documented in LRA Appendix C and found it consistent with the actions required by the respective BWRVIP safety evaluations. On the basis of consistency with the required actions, the staff finds that the applicant's response to BWRVIP applicant action items acceptable.

The staff noted that, in addition to the components listed in GALL AMP XI.M9, the applicant has included the steam dryer within its BWR Vessel Internals Program. LRA Section 3.1.2.2.11 states that cracking due to flow-induced vibration in the stainless steel steam dryers is managed by the BWR Vessel Internals Program incorporating the guidelines of GE-SIL-644, Revision 1. The LRA further states that the applicant will evaluate BWRVIP-139 upon approval by the staff and either include its recommendations in the BWR Vessel Internals Program or inform the staff of exceptions to that document.

In a letter dated October 6, 2006, the applicant stated in Commitment No. 37 that inspections of the steam dryer will follow the guidelines of BWRVIP-139 and GE-SIL 644, Revision 1.

The staff concludes that the applicant's BWR Vessel Internals Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's BWR Vessel Internals Program acceptable as consistent with the recommended GALL AMP XI.M9, "BWR Vessel Internals," with the exceptions and enhancement as described:

Exception 1. The LRA states an exception to the GALL Report program elements "scope of program" and "detection of aging effects," specifically:

> Low-Pressure Coolant Injection (LPCI) Coupling: BWRVIP-42 guidelines are not applicable to PNPS.

The LRA states that Exception 1 to inspection of the LPCI coupling is acceptable because BWRVIP-42 states guidelines for inspection and evaluation of the LPCI coupling and PNPS has no LPCI coupling.

During the audit and review, the staff reviewed BWRVIP-42 together with applicable reactor vessel design drawings and determined that the LPCI coupling is a feature of newer BWR/4, BWR/5, and BWR/6 plants and that PNPS is an earlier BWR/3 plant with no LPCI coupling. On this basis, the staff finds Exception 1 to the BWR Vessel Internals Program as described in the GALL Report acceptable.

Exception 2. The LRA states an exception to the GALL Report program elements "scope of program" and "detection of aging effects," specifically:

> Top Guide: Inspections of the four top guide hold-down assemblies and four guide aligner assemblies is not performed at PNPS. The top guide rim weld does not exist at PNPS and is therefore exempt.

The LRA states that exception 2 to inspection of the top guide is acceptable because PNPS has to account for plant-specific dynamic loading of the top guide hold-down and aligner assemblies, an analysis concluding that less than 20 percent of the weld area on the top guide hold-down and aligner assemblies is needed to resist load; therefore, in accordance with BWRVIP-26, Table 3-2, there is no inspection of the four top guide hold-down assemblies and four top guide aligner assemblies.

During the audit and review, the staff asked the applicant for a technical basis to support the LRA statement that inspection of the four top guide hold-down assemblies and four top guide aligners is not required if 20 percent or less of the weld area is sufficient to resist loads from the top guide during faulted events.

The applicant's response referred to BWRVIP-26, Table 3-2, "Matrix of Inspection Options," examination locations (2, 3), aligner pins and sockets in the top guide and shroud, and examination location (8), hold-down assemblies. The applicant noted that, as to inspection of the aligner pins and sockets, BWRVIP-26 states that if an analysis of plant-specific dynamic loading determines that less than 20 percent of the weld is required, no inspection is needed. The applicant noted further that, as to inspection of the hold-down assemblies, BWRVIP-26 recommends a VT-1 inspection only for plants whose faulted vertical loads exceed the top guide weight. The applicant provided a copy of the plant-specific evaluation showing that less than 20 percent of the weld area is sufficient to resist loads from the top guide during faulted events. In addition, the applicant stated that BWRVIP-26, Figure A-1, "Evaluation of Need for Hold Down Devices," includes a data point for the top guide, and the plant-specific data show that vertical loads during a faulted event do not exceed the weight of the top guide. The staff reviewed applicable BWRVIP-26 sections and the plant-specific evaluations and noted that BWRVIP-26 itself provides the criteria on which the applicant based its determination that inspection of the top guide hold-down assemblies and top guide aligners is not required; consequently, the applicant's decision not to inspect these components is no exception to the BWRVIP-26 recommendations.

Based on these reviews, the staff determines that the applicant's appropriate plant-specific evaluations are consistent with the BWRVIP-26 recommendations and that inspections of the top guide hold-down assemblies and top guide aligners are not required. On this basis, the staff finds the applicant's response acceptable.

During the audit and review, the staff asked the applicant to further address the LRA statement that there is no top guide rim weld. Specifically, the staff asked the applicant to clarify whether there is no top guide rim weld or whether it is assumed to be fully cracked and whether, if there never has been a rim weld, to explain how the bottom plate of the top guide is attached to the rim of the top guide.

The applicant responded that the rim of the top guide and the bottom plate of the top guide were fabricated as one machined integral piece without an attachment weld. The applicant also provided a fabrication drawing for the top guide showing in detail the rim and the bottom plate of the top guide as one integral piece.

On the basis that the additional information from the applicant confirmed that there is no attachment weld between the top guide's rim and bottom plate, the staff finds the response acceptable.

Based on the staff's questions and the acceptability of the applicant's responses as described, the staff finds Exception 2 to the BWRVIP as described in the GALL Report acceptable.

Exception 3. The LRA states an exception to the GALL Report program elements "scope of program" and "detection of aging effects," specifically:

> Core Spray: PNPS defers inspection of three inaccessible welds inside each of the two core spray nozzles until a delivery system for UT of the hidden welds is developed. Thus, PNPS does not meet the BWRVIP-18 requirement to perform an ultrasonic inspection of a full target weld set every other RFO.

The LRA states that exception 3 to the recommended inspection of three inaccessible welds inside each core spray nozzle, is acceptable because inspection of similar creviced and uncreviced welds (including junction box-to-pipe welds, upper elbow welds, junction box cover plate weld, P1 weld, and down comer sleeve welds) showed no indication of cracking. The applicant stated that, therefore, deferred inspection of the inaccessible welds is justified.

During the audit and review, the staff reviewed the Reactor Vessel Internals Program inspection and implementing procedure and the technical justification for deferred inspection of core spray hidden welds. The technical justification states that there are three hidden welds inside each of the two core spray nozzle thermal sleeves not accessible for visual examination, and no inspection technique has been developed for the thermal sleeve welds either with some degree of component disassembly or through development of specialized tooling. The technical justification further states that, according to BWRVIP-18, a qualitative assessment of thermal sleeve integrity can be based on a plant-specific evaluation of similar core spray piping welds (evaluation welds) and that none of the evaluation welds (28 in all) show any indications of cracking. The technical justification also states that, according to BWRVIP-18, a thermal sleeve weld that cracks to the point of separation and its attached core piping might undergo some displacement; however, the brackets holding the piping or the tight clearance between the thermal sleeve and nozzle wall would prevent gross separation and, in such an extreme scenario, core spray would continue but with some leakage.

During the audit and review, the staff also reviewed the BWRVIP inspection program document and determined that the program requires, when tooling becomes available, core spray hidden welds inspected per BWRVIP-18 requirements. The staff asked the applicant for a status summary of current industry activities to develop a delivery system for UT of the hidden welds in the core spray system.

The applicant responded with the following information:

> The BWRVIP/EPRI NDE Center recently acquired blade probes to demonstrate UT capability. Plans for 2007 are to develop a white paper to document the inspection capability to examine the hidden thermal sleeve welds. This project excludes tooling development as it is left to inspection vendors.

In addition, in a letter dated September 13, 2006, the applicant committed (Commitment No. 33) to inspect the inaccessible jet pumps and core spray thermal sleeves welds if and when the necessary technique and equipment become available.

Based on its review of the applicant's technical justification for deferred inspection of the hidden core spray thermal sleeve welds and on the applicant's response, the staff determines that (1) there is no qualified tooling for inspection of the hidden core spray thermal sleeve welds; (2) the applicant currently examines other RV welds with the same material and environment conditions as the hidden welds; (3) the industry, through BWRVIP/EPRI, plans to develop a white paper to document capability to examine the hidden welds; and (4) the applicant's BWRVIP guidance document and its Commitment No. 33 include inspection of the hidden welds when appropriate tooling is developed. Based on these determinations, the staff finds Exception 3 to the BWRVIP as described in the GALL Report acceptable.

Exception 4. The LRA states an exception to the GALL Report program elements "scope of program" and "detection of aging effects," specifically:

> Jet Pump Assembly: PNPS defers inspection of jet pump inaccessible welds until a delivery system for UT of the hidden welds is developed. Thus, PNPS does not meet the BWRVIP-41 requirement to perform a modified VT-1 of 100 percent of these welds over two 6-year inspection cycles and 25 percent per inspection cycle thereafter.

The LRA states that exception 4 to the recommended inspection of jet pump assembly inaccessible welds is acceptable because the hidden jet pump welds are far enough into the nozzle that failure at these welds would not cause the thermal sleeve to disengage from the nozzle before the riser contacts the shroud. Further, if the jet pump thermal sleeve were severed, the riser brace would maintain the geometry of the jet pump until leakage would be detected through operational parameters and the plant could be shut down safely. The applicant further stated that it had instituted hydrogen water chemistry (HWC) in 1991 to mitigate cracking in the reactor internals and to address crack growth in the jet pump thermal sleeve welds. Therefore, deferred inspection of the inaccessible welds is justified.

During the audit and review, the staff reviewed the BWRVIP inspection and implementation procedure and the technical justification for deferred inspection of jet pump hidden welds. The applicant's technical justification states that there are two hidden welds (TS-3 and TS-4) inside each of the jet pump recirculation inlet nozzles described as circumferential welds that attach the thermal sleeve in a trombone arrangement inside each of the 10-jet pump recirculation inlet nozzles. The staff reviewed BWRVIP-41 Figure 2.3.3-1, "Configurations for Thermal Sleeves," and determined that the TS-4 weld attaches the outer thermal sleeve to the vessel nozzle wall and the TS-3 weld attaches the inner thermal sleeve to the outer thermal sleeve. The applicant's technical justification further states that the hidden welds are not accessible for visual examination and that there is no inspection technique for inspection either with some degree of component disassembly or through development of specialized tooling. The applicant's technical justification states that there are in each of the 10 jet pump risers (RS-1, RS-2, and RS-3) three accessible welds of similar material in a similar environment and subject to similar operational loading that can be considered indicator welds for the hidden thermal sleeve welds. The technical justification notes that no cracking was found in the hidden thermal sleeve welds when they were accessible during the recirculation piping replacement in RFO 6 (1984) and that similar riser sleeve welds have been inspected during recent RFOs and will be inspected during the period of extended operation as recommended by BWRVIP-41. It also states that all of the similar riser sleeve welds have been free of cracks, that technical specifications include operability criteria for monitoring jet pump integrity, and that, even with severance of the jet pump thermal sleeve, the riser brace would maintain jet pump geometry until operational parameters would detect failure of the weld and ensure safe plant shutdown.

During the audit and review, the staff also reviewed the BWRVIP inspection program document and determined that the program requires, when tooling becomes available, inspection of the jet pump thermal sleeve hidden welds per BWRVIP-41. The staff asked the applicant for a status summary of industry activities to develop a delivery system for UT of the core spray system hidden welds.

The applicant responded with the following information:

> The BWRVIP/EPRI NDE Center recently acquired blade probes to demonstrate UT capability. Plans for 2007 are to develop a white paper to document the inspection capability to examine the hidden thermal sleeve welds. This project excludes tooling development as it is left to inspection vendors.

In its response dated September 13, 2006, the applicant included Commitment No. 33 to inspect the jet pump thermal sleeve inaccessible welds if and when the necessary technique and equipment become available and are demonstrated by the vendor, including delivery system.

Based on its review of the applicant's technical justification for deferred inspection of the hidden welds in the jet pump thermal sleeves and the applicant's response, the staff determines that (1) there is no qualified tooling for inspection of the hidden welds in the jet pump thermal sleeves; (2) the applicant examines other RV welds with the same material and environment conditions as the hidden welds; (3) the industry, through BWRVIP/EPRI, plans to develop a white paper to document capability to examine the hidden welds; and (4) the applicant's BWRVIP guidance document and its Commitment No. 33 require inspection of the hidden welds when appropriate tooling is developed. Based on these determinations, the staff finds Exception 4 to the BWR VIP as described in the GALL Report acceptable.

During review of the applicant's technical justification for deferred inspection of hidden welds in the jet pump thermal sleeves, the staff noted that the technical justification states that there is known cracking in nine out of ten of the thermal sleeves (but not in the TS-3 and TS-4 welds) discovered by a combination of PT and radiography when the thermal sleeves were accessible during recirculation pipe replacement in RFO 6 (1984). The technical justification states that the thermal sleeve cracking indications were quite limited in extent, intermittent, and predominantly, but not exclusively, confined to the heat-affected zones of pallet fillet welds on the outer thermal sleeve where pads were shop-welded onto the outer thermal sleeve as an assembly aid. The technical justification further states that the applicant planned to leave the thermal sleeves in place and suppress further cracking by HWC. The staff asked the applicant for more details of the jet pump thermal sleeve aging management, including considerations of the cracking discovered during the recirculation pipe replacement.

The applicant responded with the following information:

> No periodic examination of the heat affected zone for the sleeve-to-pallet fillet welds is currently performed at PNPS. VT-1 examinations will be conducted when appropriate techniques and tooling are developed by the BWRVIP organization. No repair of the cracks in the heat affected zone of the jet pump thermal sleeve has been performed and none is planned. The aging management of the jet pumps will be in accordance with BWRVIP-41, October 1997, which recommends modified VT-1 inspections of the jet pump thermal sleeves once the technique and tooling are available.
>
> PNPS submitted several letters to the Commission with regard to cracking in the heat affected zone of the jet pump thermal sleeves. The main technical report that was docketed by PNPS was General Electric Calculation NEDC-30730-P, Pilgrim Nuclear Power Station Recirculation Nozzle Repair Program and Hydrogen Water Chemistry Materials Qualification, September 1984.

The staff reviewed the applicant's response, the docketed calculation, and the NRC "Safety Evaluation Relative to Inspection and Repairs of the Reactor Coolant System" attached to the letter from Harold Denton of the NRC to William Harrington of Boston Edison Company dated December 4, 1984. The staff also reviewed a report, "Pilgrim Nuclear Power Station Recirculation Inlet Thermal Sleeve Mock Up Fabrication and Evaluation," submitted by the applicant in a letter from James Lydon of Boston Edison Company to Harold Denton dated January 2, 1987, requested by the NRC in the 1984 safety evaluation. The 1987 report provided results of a GE evaluation which concluded that the likely cause of the thermal sleeve cracking was IGSCC and that crack growth would be arrested by implementation of HWC. The staff noted that the applicant has implemented HWC credited with arresting growth in the jet pump thermal sleeves. The staff also noted that the jet pump thermal sleeves are not parts of the reactor coolant pressure boundary and are not required for the jet pump safety function of maintaining two-thirds core coverage during a loss-of-coolant accident.

In its response dated September 13, 2006, the applicant committed (Commitment No. 33) to inspect the inaccessible jet pump thermal sleeve welds if and when the technique and tooling necessary for the inspection are developed by the BWRVIP and supporting equipment vendors.

On the basis that crack growth was arrested by HWC, that the jet pump thermal sleeves are not required for a safety function, and that the applicant included a license renewal commitment to inspect inaccessible jet pump thermal sleeve welds if and when equipment becomes available through the BWRVIP, the staff finds the applicant's response acceptable.

During the audit and review, the staff asked the applicant to confirm whether it had installed the core plate wedges described in BWRVIP-25 or whether it will inspect core plate rim hold-down bolts recommended in BWRVIP-25 if wedges are not installed.

The applicant responded that the core plate wedges have been installed and described in UFSAR Section 3.3.4.1.1, "Core Shroud." The staff reviewed the UFSAR Section 3.3.4.1.1 description and the BWRVIP-25 requirements. Based on its review, the staff determines that the applicant has installed the core plate wedges described in BWRVIP-25 and that, with the wedges installed, the recommendations in BWRVIP-25, Table 3-2, "Summary of Results and Inspection Recommendations," do not require examination of the core plate rim hold-down bolts.

Based on its evaluation of Exception 4 to the BWRVIP as described, the staff finds the applicant's technical justification of this exception to the BWRVIP as described in the GALL Report acceptable. In addition, as summarized, the staff finds the applicant's responses to additional, clarifying questions acceptable and on these bases this exception acceptable.

Exception 5. The LRA states an exception to the GALL Report program element "parameters monitored/inspected," specifically:

> Table IWB-2500-1 from the 1998 Edition with 2000 Addenda of ASME Code Section XI is used, while NUREG 1801 specifies the 2001 Edition with 2002 and 2003 Addenda.

The LRA states that ASME Code Section XI through the 2003 Addenda has been accepted by reference in 10 CFR 50.55a(b)(2) without modification or limitation on use of Table IWB-2500-1 from the 1998 Edition with 2000 Addenda for BWR components; therefore, use of this version is appropriate assurance that components crediting this program can perform intended functions consistent with the CLB during the period of extended operation.

During the audit and review, the staff asked the applicant to substantiate that all exceptions to the GALL Report program recommendations had been identified by reconfirming that its BWR Vessel Internals Program performs the inspections recommended in the approved BWRVIP guidelines, including those with requirements more stringent than ASME Code Section XI except as documented in the LRA under "Exceptions to NUREG-1801."

The applicant responded with the following information:

> The PNPS BWR Vessel Internals Program will perform the more stringent inspections in the BWRVIP inspection and evaluation guidelines approved by the NRC for referencing for license renewal. Any exceptions to the approved BWRVIPs are discussed as exceptions to NUREG-1801.
>
> Note that some of the specific BWRVIPs are considered part of subprograms such as the BWR Penetrations Program or the BWR Vessel ID Attachment Welds Program; however, all are implemented through the Reactor Vessel Internals Program implementing procedure at the PNPS site.

The staff reviewed the responses, the applicant's fourth 10-year inspection program plan, and the applicant's response to BWRVIP applicant action items as documented for LRA Appendix C. Based on these reviews, the staff determines that the applicant's use of ASME Code Section XI, 1998 Edition with 2000 Addenda as the basis for its BWR Vessel Internals Program is consistent with its fourth 10-year inspection program plan. In addition the staff determines that the applicant has complied with the applicant action items for BWRVIP documents credited for license renewal. Based on these determinations, the staff finds Exception 5 to the BWR Vessel Internals Program as described in the GALL Report acceptable.

Enhancement. The LRA states an enhancement to the GALL Report program element "scope of program," specifically:

> The PNPS top guide fluence is projected to exceed the threshold for IASCC ($5x10^{20}$ n/cm^2) before the period of extended operation. Therefore, 10 percent of the top guide locations will be inspected using enhanced visual inspection technique (EVT-1) within the first 12 years of the period of extended operation, with one-half of the inspections (50 percent of locations) to be completed within the first 6 years of the period of extended operation. Locations selected for examination will be areas that have exceeded the neutron fluence threshold.

The LRA states that this enhancement will start before the period of extended operation.

During the audit and review, the staff noted that the LRA describes this and other enhancements as "initiated" before the period of extended operation. The staff noted that in describing an enhancement as "initiated" rather than "implemented," the LRA wording is ambiguous as to whether the enhancement will be implemented fully before the period of extended operation. The staff asked the applicant to clarify or resolve the ambiguity in the LRA enhancement descriptions.

In its response dated September 13, 2006, the applicant stated that enhancements will be implemented fully before the period of extended operation. As the applicant's response provided the clarification requested, the staff finds it acceptable.

During the audit and review, the staff noted that the enhancement, as described in the LRA, does not examine the top guide during the final eight years of the period of extended operation. The staff asked the applicant to describe plans for inspection of top guide locations during the final eight years of the 20-year period of extended operation.

In its response dated September 13, 2006, the applicant revised the enhancement to require inspection of at least 15 percent of the top guide locations during the first 18 years of the period of extended operation as Commitment No. 3:

> Inspect fifteen (15) percent of the top guide locations using enhanced visual inspection technique, EVT-1, within the first 18 years of the period of extended operation, with at least one-third of the inspections to be completed within the first six (6) years, and at least two-thirds within the first 12 years of the period of extended operation. Locations selected will be areas that have exceeded the neutron fluence threshold.

The staff reviewed the applicant's response and evaluation of the "scope of program" program element of its current BWR Vessel Internals Program in the program evaluation report. The staff determined that the applicant's program evaluation report states that the enhancement to inspect top guide locations, as described in the LRA, is necessary to bring the BWR Vessel Internals Program into compliance with BWRVIP-26 guidelines. The staff also reviewed selected implementing procedures and found that the current BWRVIP does not require inspection of the top guide when neutron fluence has exceeded the irradiation-assisted stress corrosion cracking (IASCC) threshold as recommended in the GALL Report.

On the bases that the enhancement is necessary for compliance with GALL AMP Section XI.M9 (BWR Vessel Internals) recommendations for the top guide and that the applicant has revised the enhancement as originally described in the LRA to include examinations during the final eight years of the period of extended operation, the staff finds the enhancement to the BWR Vessel Internals Program acceptable.

Operating Experience. LRA Section B.1.8 states that visual and enhanced visual examinations of vessel internals (shroud support plate gusset welds, core spray piping, jet pump riser braces, jet pump diffusers, CRD guide tube handle attachment, steam dryer, and feedwater spargers) during RFO 14 (April 2003) revealed no new recordable indications. Previous visual and enhanced visual examinations of vessel internals had revealed indications on core spray piping welds and steam dryer leveling screw tack welds. The LRA states that the absence of new recordable indications on the vessel internals provides evidence that the program effectively manages cracking of the welds. Further, visual and enhanced visual examinations of vessel internals (core spray piping welds, core spray spargers, integrally welded core support structures, jet pump restrainer wedges, shroud vertical welds, shroud top guide ring, shroud support, steam dryer, steam dryer level screw tack weld cracks, steam separator/shroud head, and top guide grid beams) during RFO 15 (April 2005) revealed no new recordable indications. The LRA states that the absence of new recordable indications on the vessel internals provides evidence that the program effectively manages cracking of the welds. The core shroud provides 2/3-core coverage in a loss-of-coolant accident. In 1995, the applicant implemented a preemptive shroud hold-down modification during RFO 10 due to the industry issue of IGSCC of sensitized shroud welds.

The staff did not agree with the applicant that the absence of recordable indications provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of cracking.

During the audit and review, the staff noted that the LRA included little operating history earlier than approximately 2000. The staff asked the applicant to address the limitations on its operating history in the LRA and whether its presentation is consistent with the requirements of SRP-LR Section A.1.2.3.10 (Branch Technical Position RLSB-1, "Operating Experience").

The applicant responded with the following statement:

> SRP Section A.1.2.3.10 states, "Operating experience with existing programs should be discussed." To identify operating experience for license renewal, Entergy focused on operating experience with the existing programs rather than operating experience from the program that existed 10 or 15 years ago. Entergy did not own the plant 10 years ago. Entergy focused on operating experience from the existing programs rather than operating experience from the program that existed 10 or 15 years ago because results of the earlier inspections do not provide information regarding existing program effectiveness. In addition, BWRVIP programs incorporate industry operating experience from the entire BWR fleet. The PNPS programs are based on NUREG-1801 programs which are also based on industry experience.

The staff determined that the applicant's response reasonably explained its decisions on presentation of "operating experience" in the LRA and that the LRA presentation is consistent with SRP-LR Section A.1.2.3.10. On this basis, the staff finds the applicant's response acceptable.

The staff reviewed the operating experience presented in the LRA and determined that this program does not manage cracking of the nozzles and piping, rather it is used to monitor the stainless steel reactor coolant nozzles and piping using ASME Code Section XI, Appendix VIII qualified procedures and operators. Using a qualified procedure and qualified operator will ensure that recordable indications will be detected during future UT inspections. In addition, the staff interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.8, the applicant provided the UFSAR supplement for the BWR Vessels Internals Program. During the audit and review, the staff noted that the applicant's description of the program in the UFSAR supplement in LRA Appendix A did not include, as a commitment, the enhancement described in LRA Section B.1.8, "BWR Vessel Internals." The staff asked the applicant to include a description of the enhancement to BWR Vessel Internals Program in the UFSAR supplement in LRA Appendix A.

In its response dated October 6, 2006, the applicant revised LRA Section A.1.2.8, BWR Vessel Internals Program, to add, "License renewal commitments 3, 33, and 37 specify enhancements to this program." The staff reviewed this section and determined 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 audit and review of the applicant's BWR Vessels Internals Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. Also, the staff reviewed the enhancement and confirmed that its implementation prior to the period of extended operation would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 Diesel Fuel Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.10, "Diesel Fuel Monitoring," describes the existing Diesel Fuel Monitoring Program as consistent, with exceptions and enhancements, with GALL AMP XI.M30, "Fuel Oil Chemistry."

The program entails sampling to maintain adequate diesel fuel quality to prevent plugging of filters, fouling of injectors, and corrosion of fuel systems. Exposure to water, microbiological organisms, and other fuel oil contaminants is minimized by periodic draining and cleaning of tanks and by verifying new oil quality before its introduction into the storage tanks. Sampling and analysis are in accordance with technical specifications on fuel oil purity and the guidelines of ASTM Standards D4057-81 and D975-81 or revisions.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.8. The staff reviewed the exceptions and enhancements to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the Diesel Fuel Monitoring Program for which the applicant claims consistency with GALL AMP XI.M30 and found them consistent. Furthermore, the staff concludes that the applicant's Diesel Fuel Monitoring Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Diesel Fuel Monitoring Program acceptable as consistent with the recommended GALL AMP XI.M30, "Fuel Oil Chemistry," with the exceptions and enhancements as described:

Exception 1. The LRA states an exception to the GALL Report program elements "scope of program" and "acceptance criteria," specifically:

> PNPS indicated in the LRA that sampling and analysis activities are in accordance with technical specifications on fuel oil purity and the guidelines of ASTM Standards D4057-81 and D975-81. However, NUREG-1801, Revision 1, specifies ASTM Standards D1796, D2276, D2709, and D6217.

The LRA states that PNPS technical specifications specify use of ASTM D975-81, which recommends use of ASTM D2276. Therefore, the guidelines of D2276 are appropriate for determination of particulates.

During the audit and review, the staff asked the applicant to justify not using all ASTM specifications as indicated in the GALL Report, Revision 1.

The applicant responded that the Diesel Fuel Monitoring Program uses ASTM D2276 guidelines for determination of particulates in lieu of ASTM D6217. ASTM D2276 provides guidance for determination of particulate contamination by a field monitor for rapid assessment of contamination level changes without the delay required by rigorous laboratory procedures. It also provides a laboratory filtration method by an 0.8 micron filter. ASTM D6217 provides guidance for determination of particulate contamination by sample filtration at an offsite laboratory. The D2276 acceptance criterion is 10 milligrams (mg) per liter, more stringent than that of D6217 at 24 mg/liter. As ASTM D2276 is an accepted method for determination of particulates and a method recommended by ASTM D975, the applicant uses the D2276 method.

On this basis, the staff finds the exception acceptable.

Exception 2. The LRA states an exception to the GALL Report program element "preventive actions," specifically:

> The quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. Periodic cleaning of a tank allows removal of sediments, and periodic draining of water collected at the bottom of a tank minimizes the amount of water and the length of contact time. Accordingly, these measures are effective in mitigating corrosion inside diesel fuel oil tanks. Coatings, if used, prevent or mitigate corrosion by protecting the internal surfaces of the tank from contact with water and microbiological organisms.

The applicant indicated that it uses no additives beyond those of the refiner. As recommended by the GALL AMP XI.M30, Revision 1, the applicant adds no biocides, stabilizers, or corrosion inhibitors.

The LRA states that the applicant adds no biocides, stabilizers, or corrosion inhibitors to the diesel fuel. Plant-specific operating experience indicates no significant problems from microbiologically-influenced corrosion (MIC). As water contamination in the diesel fuel storage tanks is minimized, MIC potential is limited.

During the audit and review, the staff found program documentation indicating that tanks, except the security diesel generator fuel storage tank, are periodically drained, cleaned, and inspected. The quality of new oil is verified before its introduction to storage tanks. This exception to the GALL Report, Revision 1, is acceptable for all tanks except the security diesel generator fuel storage tank because no degradation of or water contamination in the fuel storage tanks has been detected to date and the Diesel Fuel Monitoring Program will be enhanced to include UT of tank bottoms (except the security diesel generator fuel storage tank) as explained under Exception 3. If indications of degradation or water contamination are found, the applicant will consider additions of corrosion inhibitors and biocides during the corrective action process.

On these bases, the staff finds this exception acceptable.

Exception 3. The LRA states an exception to the GALL Report program element "preventive actions," specifically:

> The security diesel generator fuel storage tank is not periodically cleaned and inspected because the internals are inaccessible.

The LRA states that the security diesel fuel storage tank has no manways or other access to the internals; therefore, no preventive action is taken for the security diesel generator fuel storage tank because the internals are inaccessible.

During the audit and review, the staff asked the applicant to justify not cleaning and visually inspecting the security diesel generator fuel storage tank periodically.

The applicant responded with information as to how loss of material due to MIC and general corrosion will be managed. The security diesel generator fuel storage tank is double-walled. Instrumentation will be added to monitor leakage between the two walls of the tank, and the fuel will be sampled for water contamination at the bottom of the tank. A modification for instrumentation will be installed before the period of extended operation. In its response dated September 13, 2006, the applicant added Commitment No. 5 to enhance the Diesel Fuel Monitoring Program to install instrumentation to monitor for leakage between the two walls of the security diesel generator fuel storage tank so significant degradation does not occur. Water is necessary for MIC and general corrosion in the fuel oil environment. Verification that water is not present at the tank bottom will ensure that loss of material does not occur. This exception to the GALL Report, Revision 1, is acceptable for the security diesel generator fuel storage tank because the two program enhancements will ensure corrective action before the tank is breached due to loss of material.

On this basis, the staff finds this exception acceptable.

Exception 4. The LRA states an exception to the GALL Report program elements "parameters monitored/inspected" and "acceptance criteria," specifically:

> Determination of particulates may be according to ASTM Standard D2276 rather than modified ASTM D2276 Method A.

The LRA states that determination of particulates may be according to ASTM Standard D2276, which conducts particulate analysis by a 0.8- rather than the 3.0-micron filter specified in the GALL Report. Use of a filter with a smaller pore size samples more particulates because smaller particles are retained. Thus, use of a 0.8 micron filter is more conservative than use of the 3.0 micron filter specified in the GALL Report.

During the audit and review, the staff determined that the applicant's procedure to determine particulate levels is more conservative than that of the GALL Report, Revision 1 and, therefore, concluded that the testing methods adequately detect unacceptable levels of particulates. During the site audit and review, the staff reviewed ASTM D6217-98 and ASTM D2276-00 and could not find the acceptance criteria in either of these standard test methods. The staff asked the applicant for additional explanation of the source of the acceptance criteria.

The applicant responded that there are no acceptance criteria in ASTM D6217-98 and ASTM D2276-00, that acceptance criteria sources are ASTM D975, Table 1, for water and sediment, and VV-F-800D, "Federal Specification, Fuel Oil Diesel," for particulates. The staff reviewed ASTM D975, Table 1 and VV-F-800D and found the acceptance criteria adequate to manage water, sediment, and particulate contamination.

On this basis, the staff finds this exception acceptable.

Enhancement 1. The LRA states an enhancement to the GALL Report program element "scope of program," specifically:

> The Diesel Fuel Monitoring Program will be enhanced to include periodic sampling of the security diesel generator fuel storage tank, near the bottom, to determine water content.

The LRA states that the Diesel Fuel Monitoring Program will be enhanced to include sampling the bottom of the security diesel generator fuel storage tank for water (Commitment No. 4). Any indication of water contamination will be handled by the corrective action program with consideration of additions of biocides and corrosion inhibitors. As the effect of any water contamination is minimized, the potential for MIC and general corrosion will be limited, adding assurance that loss of material will be adequately managed.

On this basis, the staff finds the enhancement acceptable because with the enhancement the Diesel Fuel Monitoring Program will be consistent with GALL AMP XI.M30 and will add assurance of adequate management of aging effects.

Enhancement 2. The LRA states an enhancement to the GALL Report program element "detection of aging effects," specifically:

> The Diesel Fuel Monitoring Program will be enhanced to include periodic ultrasonic measurement of the bottom surface of the security diesel generator fuel storage tank to ensure that significant degradation is not occurring.

The LRA states that the Diesel Fuel Monitoring Program would be enhanced by periodic ultrasonic inspection of the bottom surface of the security diesel generator fuel storage tank. However, during the site audit, the applicant indicated that UT is not possible at the bottom of the security diesel generator fuel storage tank because of tank geometry and installation configuration. Therefore, this enhancement was revised to add instrumentation to monitor leakage between the two walls of this tank (Commitment No. 5). This enhancement to the Diesel Fuel Monitoring Program will implement corrective action before the outer tank wall is breached due to loss of material, adding assurance of adequate management of aging effects.

On this basis, the staff finds the enhancement acceptable because with the enhancement the Diesel Fuel Monitoring Program will be consistent with GALL AMP XI.M30 and will add assurance of adequate management of aging effects.

Enhancement 3. The LRA states an enhancement to the GALL Report program element "acceptance criteria," specifically:

> UT measurements of tank bottom surfaces will have an acceptance criterion of greater than or equal to 60 percent nominal thickness (Tnom).

During the audit and review, the staff asked the applicant to justify the "greater than or equal to 60 percent of nominal thickness" acceptance criterion.

The applicant's original response stated that the acceptance criterion was based on one set of UT measurements where the minimum wall thickness was 95 percent of the nominal wall thickness. During the site audit, the applicant stated that, although this difference was likely due to normal variation of the wall thickness during fabrication, it assumed that it was the result of aging degradation. Projection of this thinning rate indicated that the "greater than or equal to 60 percent of nominal thickness" acceptance criterion will not be exceeded during the period of extended operation even by a doubled thinning rate; however, the staff indicated that there was no basis to show that the tanks would perform intended functions with wall thinning down to 60 percent of the nominal wall thickness. Therefore, the applicant revised this enhancement to specify acceptance criterion for UT measurements of the EDG fuel storage tanks (T-126A&B).

In its response dated September 13, 2006, the applicant revised LRA Appendix A to include acceptance criteria for UT measurements of EDG fuel storage tanks (T-126A&B) before the period of extended operation (Commitment No. 6).

During the audit and review, the staff asked two additional questions about UT measurements of the diesel fuel tanks:

(1) Will tank bottoms be subjected to 100-percent UT inspection?

The applicant responded that tank bottoms would not be 100-percent inspected. Rather, there would be periodic UT measurements on the bottom surface of the underground emergency diesel fuel oil storage tanks at several random locations. This response is acceptable because random measurements will be able to trend any loss of tank bottom material.

(2) If reduction of thickness is discovered during UT, will microbiological activity be monitored and biocide added in the future? If not, the staff asked the applicant for justification.

The applicant responded that in accordance with the corrective action program there would be an engineering evaluation into the cause if test acceptance criteria are not met and corrective actions would maintain the intended function of the tanks consistent with the CLB for the period of extended operation. If appropriate to address the cause, biocide addition may be a corrective action. This response is acceptable because no evidence of MIC in diesel fuel storage tanks has been discovered to date, and biocide addition will be considered as corrective action if evidence of MIC is discovered (*e.g.*, during UT measurements or visual examinations).

On this basis, the staff finds the enhancement acceptable because with the enhancement the Diesel Fuel Monitoring Program will be consistent with GALL AMP XI.M30 and will add assurance of adequate management of aging effects.

Operating Experience. LRA Section B.1.10 states that in 2001 two diesel fuel oil deliveries were rejected, one because the oil viscosity was too low and the other because the oil had visible particulate contamination. Rejection of inferior fuel shipments maintains diesel fuel quality to prevent loss of material and cracking of fuel system components. Monthly sampling of the B EDG fuel oil tank and the B station blackout (SBO) fuel oil tank in August 2003 found a small amount of water in the tanks. Gaskets were replaced although subsequent testing determined that the water finding had been false and that the tanks were water-free. Sampling of the B EDG fuel oil tank in January 2005 found a small amount of water in the tank; however, subsequent testing confirmed the tank to be water-free. Other fuel oil sampling results from 2000 through August 2005 found fuel oil quality maintained in compliance with acceptance criteria. A 1998 visual and ultrasonic inspection of A and B diesel fuel oil storage tank internals revealed no degradation. A 2002 visual inspection of A and B SBO fuel oil storage tank internals revealed no degradation. The LRA states the continuous confirmation of diesel fuel quality, timely corrective actions, and absence of degradation in the fuel oil storage tanks provide evidence that the program effectively manages loss of material and cracking of fuel system components.

The staff agrees that continuous confirmation of diesel fuel quality and timely corrective actions provides evidence that the program effectively manages loss of material and cracking of fuel system components. The staff did not agree with the applicant that the absence of degradation provides evidence that the program effectively manages the effects of aging.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.10, the applicant provided the UFSAR supplement for the Diesel Fuel Monitoring Program. During the audit and review, the staff noted that the applicant's description of the program in the UFSAR supplement in LRA Appendix A did not include, as commitments, the enhancements described in LRA Section B.1.10. The staff asked the applicant to include a description of the enhancements to its B.1.10 program in the UFSAR supplement in LRA Appendix A per SRP-LR Section 3.1.2.4.

In a letter dated September 13, 2006, Commitment Nos. 4, 5, and 6 specify enhancements to this program. The staff then determined 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 audit and review of the applicant's Diesel Fuel Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. Also, the staff reviewed the enhancements and confirmed that their implementation prior to the period of extended operation would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Fatigue Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.12, "Fatigue Monitoring," describes the existing Fatigue Monitoring Program as consistent, with exceptions, with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary."

In order not to exceed design limits for fatigue, the Fatigue Monitoring Program tracks the number of critical thermal and pressure transients for selected reactor coolant system components and confirms the validity of analyses that explicitly assume a specified number of such fatigue transients by ensuring that the actual effective number of transients is not exceeded.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.9.

The staff reviewed those portions of the Fatigue Monitoring Program for which the applicant claimed consistency with GALL AMP X.M1 and found them consistent.

In a letter dated August 28, 2007, the applicant amended the LRA with respect to its basis for its environmentally-assisted fatigue analysis. In this letter, the applicant clarified that Option 1 of Commitment No. 31 for refined CUF calculations is consistent with the NRC's recommendations for the periodic CUF updates in the "monitoring and trending" (i.e., program element 4) of GALL AMP X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary," and that Options 2 and 3 of Commitment No. 31 are considered to be corrective actions that are consistent with the corrective actions recommended in the "corrective action" (i.e., program element 7) of the same GALL AMP. Based on these clarifications, the applicant amended the LRA to bring Commitment No. 31 within the scope of the applicant's Fatigue Monitoring Program and to credit this AMP as the basis for accepting this TLAA in accordance with 10 CFR 54.21(c)(1)(iii). In the LRA amendment, the applicant also stated that the Fatigue Monitoring Program is consistent with GALL AMP X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary," without exception. The staff determined that the changes proposed by the applicant are consistent with the NRC's recommendations in GALL AMP X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary." Based on this assessment, the staff concludes that the Fatigue Monitoring Program is consistent with GALL AMP X.M1 without exception and is acceptable.

Operating Experience. LRA Section B.1.12 states that industry experience has been factored into the Fatigue Monitoring Program through incorporation of regulatory guides and boiling water reactor vessel and internals program documents. The locations at which CUFs are calculated include those indicated in NUREG/CR-6260. Thermal stresses have been evaluated by the applicant and the applicant will continue to evaluate future plant and industry experience with fatigue of Class 1 components. Recent reactor shutdown and startup cycles did not trend toward exceeding the projected number of cycles, demonstrating that the program successfully monitors plant transients and tracks their accumulation.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.12, the applicant provided the UFSAR supplement for the Fatigue Monitoring Program. The staff reviewed this section and determined 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 audit and review of the applicant's Fatigue Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary," are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 Fire Protection Program

Summary of Technical Information in the Application. LRA Section B.1.13.1, "Fire Protection," describes the existing Fire Protection Program as consistent, with exceptions and enhancements, with GALL AMP XI.M26, "Fire Protection."

The fire protection program inspects fire barriers and diesel-driven fire pumps. The fire barrier inspection requires periodic visual inspection of fire barrier penetration seals and fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of fire-rated doors to maintain their operability. The diesel-driven fire pump inspection requires periodic testing of the pump so the fuel supply line can perform its intended function. The program also periodically inspects and tests the Halon fire suppression system.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.10. The staff reviewed the exceptions and enhancements to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff also noted a difference for Element 4, "detection of aging effects." The GALL Report states that the periodic (at least every six months) function test and inspection detects degradation of the halon/CO_2 fire suppression system before the loss of component intended function. However, the program evaluation report shows this test as once each operating cycle, which is different from the GALL Report frequency. The staff asked the applicant to justify why this frequency is not an exception to Element 4 and, if it is an exception, to revise the LRA to include it.

In its response dated July 19, 2006, the applicant included this exception to Element 4 of the Fire Protection Program. The staff's evaluation of this exception follows.

The staff reviewed those portions of the Fire Protection Program for which the applicant claims consistency with GALL AMP XI.M26 and found them consistent. Furthermore, the staff concludes that the applicant's Fire Protection Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Fire Protection Program acceptable as consistent with the recommended GALL AMP XI.M26, "Fire Protection," with the exceptions and enhancements as described:

Exception 1. The LRA states an exception to the GALL Report program element "scope of program," specifically:

> This program is not necessary to manage aging effects for carbon dioxide fire protection system components.

The LRA states that the CO_2 fire suppression system is not subject to an AMR.

The staff asked the applicant to justify why the CO_2 fire suppression system is not subject to an AMR.

The applicant responded that the CARDOX system is required for insurance purposes but not required to protect safety-related systems. Therefore, the system has no 10 CFR 54.4(a)(1) or (a)(3) intended functions and, because the system contains no liquids that could leak and physically interact with safety-related components, it has no 10 CFR 54.4(a)(2) intended functions.

As the system has no license renewal intended functions, the applicant's response is acceptable. On the basis that this system has no 10 CFR 54.4(a)(1), (a)(2), or (a)(3) intended functions and is therefore not within the scope of license renewal, the staff finds this exception acceptable.

Exception 2. The LRA states an exception to the GALL Report program element "detection of aging effects," specifically:

> The NUREG-1801 program states that approximately 10% of each type of penetration seal should be visually inspected at least once every refueling outage. The PNPS program specifies inspection of approximately 20% of the seals, including at least one seal of each type, each operating cycle, with all accessible fire barrier penetration seals being inspected at least once every five operating cycles.

The LRA also states that, "[s]ince aging effects typically are manifested over several years, this variation in inspection frequency is insignificant."

GALL AMP XI.M26 specifies approximately 10 percent of each type of seal should be inspected visually at least every RFO (two years). The LRA exception calls for inspection of approximately 20 percent of seals each operating cycle with all accessible penetration seals inspected at least every five operating cycles (10 years). The staff asked the applicant whether this 20 percent sample included each type of seal.

In its response dated July 19, 2006, the applicant revised the exception in LRA Section B.1.13.1 to state:

> The NUREG-1801 program states that approximately 10% of each type of penetration seal should be visually inspected at least once every refueling outage. The PNPS program specifies inspection of approximately 20% of the seals, including at least one seal of each type, each operating cycle, with all accessible fire barrier penetration seals being inspected at least once every five operating

cycles.

GALL AMP XI.M26 specifies approximately 10 percent of each type of seal should be inspected visually at least every RFO (two years). The applicant clarified that the program specifies inspection of approximately 20 percent of the seals, including at least one seal of each type, each operating cycle, with all accessible fire barrier penetration seals being inspected at least once every five operating cycles.

The applicant's need to address how to manage the aging effect of inaccessible fire barrier penetration seals was identified as Open Item (OI) 3.0.3.2.10 in the SER with OI issued in March 2007.

In response to a committee member question regarding fire barrier penetration seals during the April 4, 2007, ACRS Subcommittee meeting, the applicant stated, "[t]here are no inaccessible seals." (Reference 4) By letter dated June 21, 2007, the applicant stated that, "[t]he PNPS requirement to inspect penetration seals applies to 100 percent of the seals. The word "accessible" is not necessary in the discussion of the exception for Detection of Aging Effects in the PNPS program. In LRA Appendix B, Section B.1.13.1, the word "accessible" was removed resulting in the following description of the exception for Detection of Aging Effects."

> The NUREG-1801 program states that approximately 10% of each type of penetration seal should be visually inspected at least once every refueling outage. The PNPS program specifies inspection of approximately 20% of the seals, including at least one seal of each type, each operating cycle, with all fire barrier penetration seals being inspected at least once every five operating cycles.

The applicant clarified the PNPS fire barrier penetration seal inspection program, clarified that there are no inaccessible seals, and removed the word "accessible" from Section B.1.13.1. The staff concludes that concerns identified in OI 3.0.3.2.10 have been resolved. Open Item 3.0.3.2.10 is closed.

Both GALL AMP XI.M26 and the applicant's proposed program inspect a sample of each type of seal every refueling outage. By inspecting approximately 20 percent of the seals each outage, the PNPS fire barrier seal inspection program will accomplish inspection of 100 percent of the penetration seals in 10 years (five operating cycles). GALL AMP XI.M26 allows inspection of 100 percent of the penetration seals over 20 years (10 operating cycles). The staff evaluated the applicant's program and determined that overall it meets or exceeds the penetration seal inspection frequency recommended in the GALL Report and it adequately addresses the aging mechanism requiring management of fire barrier penetration seals. On the basis of its review, the staff concludes that the PNPS fire barrier penetration seal inspection program is effective in finding signs of penetration seal degradation during the period of extended operation. The staff is adequately assured that the fire barrier penetration seals will be considered appropriately during plant aging management activities and will continue to perform applicable intended functions consistent with the CLB for the period of extended operation.

The applicant addressed a new exception in its letter dated July 19, 2006:

Exception 3. The LRA states an exception to the GALL Report program element "detection of aging effects," specifically:

> The NUREG-1801 program recommends that functional testing and inspection of the halon fire suppression system occur at least once every 6 months. However, PNPS performs inspections at least once every 6 months and conducts functional testing annually.

In a letter dated July 19, 2006, the applicant revised the LRA to state that the variation in functional test frequency is insignificant as to detection of aging effects because functional tests are designed to verify the operability of active system components. System inspections of at least every six months detect aging effects before loss of passive component intended function.

In reviewing this exception, the staff noted that UFSAR Section 10.8.4.4.2, Halon System Surveillance Requirements, states in part that the Halon system shall be demonstrated operable at least once per operating cycle by verifying that the system and associated devices actuate upon receipt of a simulated actuation signal. An operating cycle is defined in the applicant's technical specifications as the interval between the end of one refueling outage and the end of the next subsequent refueling outage. A refueling outage, for the purpose of designating frequency of testing and surveillance, is defined as a regularly scheduled outage. Currently, the applicant refuels every 24 months.

PNPS test procedure will be enhanced to state that the Halon 1301 flex hoses shall be replaced if leakage occurs during the system functional test. In LRA Section B.1.13.1, the applicant stated that recent visual inspections of cable spreading room Halon cylinders, associated hoses, valves and piping, detected no evidence of damage or corrosion. Absence of cracks or corrosion provides evidence that the program is effective for managing aging effects for cable spreading room Halon system components.

Although the frequency of functional testing exceeds that recommended in GALL AMP XI.M26, the staff determined that it is sufficient to ensure system availability and operability with the enhancement to replace Halon 1301 flex hoses if leakage occurs during the system functional test. In addition, the station operating history indicates no aging-related events adversely affecting system operation. Based on its review, the staff finds that the 12-month frequency, which is more frequent than the applicant's CLB, is adequate for aging management considerations. On this basis, the staff finds this exception acceptable.

Enhancement 1. The LRA states an enhancement to the GALL Report program elements "parameters monitored/inspected" and "acceptance criteria," specifically:

> Procedures will be enhanced to state that the diesel engine subsystems (including the fuel supply line) shall be observed while the pump is running. Acceptance criteria will be enhanced to verify that the diesel engine did not exhibit signs of degradation while it was running, such as fuel oil, lube oil, coolant, or exhaust gas leakage.

This enhancement (Commitment No. 7) is acceptable because it will make the program consistent with GALL AMP XI.M26, Element 3, which states that the diesel fire pump is observed during performance tests for detection of any fuel supply line degradation. This enhancement is also acceptable for making the program consistent with GALL AMP XI.M26, Element 6, which states that no corrosion is acceptable in the diesel-driven fire pump fuel supply line. The staff reviewed the applicant's program procedures to confirm that these elements are consistent with the GALL Report.

On this basis, the staff finds the enhancement acceptable because with the enhancement the Fire Protection Program will be consistent with GALL AMP XI.M26 and will add assurance of adequate management of aging effects.

Enhancement 2. The LRA states an enhancement to the GALL Report program element "parameters monitored/inspected" and "acceptance criteria," specifically:

> The procedure for halon system functional testing will be enhanced to state that the halon 1301 flex hoses shall be replaced if leakage occurs during the system functional test.

This enhancement (Commitment No. 8) is acceptable for making the program consistent with the acceptance criteria in GALL AMP XI.M26, which states that any signs of mechanical damage of the halon system are not acceptable.

On this basis, the staff finds the enhancement acceptable because with the enhancement the Fire Protection Program will be consistent with GALL AMP XI.M26 and will add assurance of adequate management of aging effects.

Operating Experience. LRA Section B.1.13.1 states that inspections of fire stops, fire barrier penetration seals, and fire barrier walls, ceilings, and floors from 1998 through 2004 revealed cracks, gaps, voids, holes, and missing material as signs of degradation. Revelation of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects for fire barrier components.

Visual inspections and functional tests of fire doors from 1998 through 2004 detected corrosion, wear, and missing parts as degradation of fire doors. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages loss of material for fire doors. Observation of the diesel-driven fire pump during a performance test in 2000 revealed leakage from the cooling system. The cause was determined to be corrosion of the heat exchanger shell, which was repaired.

Observation of the diesel-driven fire pump during performance tests in 2001 revealed degradation of several components in the engine oil and coolant systems. The pump also failed a flow test. Therefore, the entire assembly (engine, controller, and pump) was replaced in 2002. Revelation of degradation and corrective action provide evidence that the program effectively manages aging of diesel-driven fire pump subsystem components.

Recent (2002 and 2003) visual inspections of cable spreading room Halon cylinders and their hoses, valves, and piping detected no evidence of damage or corrosion. The LRA states that the absence of cracks or corrosion provides evidence that the program effectively manages aging effects for cable spreading room Halon system components.

The staff did not agree with the applicant that the absence of cracks or corrosion provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of cracks or corrosion.

On July 31, 2003, the staff completed a triennial fire protection team inspection to assess whether the applicant had implemented an adequate fire protection program and established properly maintained post-fire safe shutdown capabilities. Results confirmed that the applicant had maintained the fire protection systems in accordance with their fire protection program, detecting program deficiencies and implementing appropriate corrective actions. The staff team also evaluated the material condition of fire walls, fire doors, fire dampers, and fire barrier penetration seals and concluded that the applicant had maintained passive features in a state of readiness. Further, a QA audit in May 2004 and a staff inspection in June 2005 revealed no issues or findings with impact on program effectiveness to manage aging effects for fire protection components.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.13, the applicant provided the UFSAR supplement for the Fire Protection Program. During the audit and review, the staff noted that the applicant's description of the program in the UFSAR supplement in LRA Appendix A did not include, as commitments, the enhancements described in LRA Section B.1.13.1, "Fire Protection." During the Audit and Review the staff asked the applicant to include a description of the enhancements to its Fire Protection Program in the UFSAR supplement in LRA Appendix A.

In its response dated September 13, 2006, the applicant stated that Commitment Nos. 7 and 8 specify enhancements to this program regarding the fire pump diesel engine, the diesel engine subsystems and the Halon system. The staff then determined 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 audit and review of the applicant's Fire Protection Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. Also, the staff reviewed the enhancements and confirmed that their implementation prior to the period of extended operation would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 Fire Water System Program

Summary of Technical Information in the Application. LRA Section B.1.13.2, "Fire Water System," describes the existing Fire Water System Program as consistent, with exception and enhancements, with GALL AMP XI.M27, "Fire Water System."

This program maintains water-based fire protection systems that consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, and above-ground and underground piping and components tested by National Fire Protection Association (NFPA) codes and standards to assure functionality. Many of these systems normally are maintained at required operating pressure and monitored to detect leakage causing loss of system pressure and to initiate corrective actions immediately.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.11. The staff reviewed the exception and enhancements to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the Fire Water System Program for which the applicant claims consistency with GALL AMP XI.M27 and found them consistent. Furthermore, the staff concludes that the applicant's Fire Water System Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Fire Water System Program acceptable as consistent with the recommended GALL AMP XI.M27, "Fire Water System," with the exception and enhancements as described:

Exception. The LRA states an exception to the GALL Report program element "detection of aging effects," specifically:

> NUREG-1801 specifies annual fire hydrant hose hydrostatic tests. Under the PNPS program, hydrostatic test of hoses occurs once per 3 years. NUREG-1801 specifies annual gasket inspections. Under the PNPS program, visual inspection, reracking, and replacement of gaskets in couplings occurs at least once per operating cycle. NUREG-1801 specifies annual fire hydrant flow tests. Under the PNPS program, verification of operability and no-flow blockage occurs at least once every two fuel cycles.

The LRA states that, as aging effects typically are manifested over several years, differences in inspection and testing frequencies are insignificant. The staff reviewed the applicant's License Renewal Project Operating Experience Review Report to determine any age-related issues with fire water system components. The review determined a few instances of age-related degradation over the last five years. However, these were all detected by the program. Further, the applicant informed the staff that the surveillance intervals for these fire water system related tests are specified in FSAR, Revision 21, dated October 1997, summarizes the fire protection program and commitments to 10 CFR 50.48 using BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," May 1, 1976, and Appendix A to BTP APCSB 9.5-1, August 23, 1976. The three year testing frequency is specified in the PNPS approved Fire Protection Program and was part of the original licensing basis until the fire protection requirements were removed from the technical specifications and placed in the FSAR.

The staff finds these frequencies are part of the CLB and the review of operating experience indicated that these frequencies are reasonable and adequate to manage the aging effects. On these bases, the staff finds this exception acceptable.

Enhancement 1. The LRA states an enhancement to the GALL Report program elements "parameters monitored/inspected" and "acceptance criteria," specifically:

> Procedures will be enhanced to include inspection of hose reels for corrosion. Acceptance criteria will be enhanced to verify no significant corrosion.

This enhancement (Commitment No. 9) is acceptable as it will make the program consistent with GALL AMP XI.M27, Elements 3 and 6.

Enhancement 2. The LRA states an enhancement to the GALL Report program element "detection of aging effects," specifically:

> A sample of sprinkler heads will be inspected using the guidance of NFPA 25 (2002 Edition), Section 5.3.1.1.1. NFPA 25 also contains guidance to repeat this sampling every 10 years after initial field service testing.

The staff finds this enhancement (Commitment No. 10) acceptable because with the enhancement the Fire Water System Program will be consistent with GALL AMP XI.M27, Element 4, and will add assurance of adequate management of aging effects.

Enhancement 3. The LRA states an enhancement to the GALL Report program element "detection of aging effects," specifically:

> Wall thickness evaluations of fire protection piping will be performed on system components using nonintrusive techniques (*e.g.*, volumetric testing) to identify evidence of loss of material due to corrosion. These inspections will be performed before the end of the current operating term and at intervals thereafter during the period of extended operation. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified before loss of intended function.

The staff finds this enhancement (Commitment No. 11) acceptable because when implemented the Fire Water System Program will be consistent with GALL AMP XI.M27, Element 4, and will add assurance of adequate management of aging effects.

Operating Experience. LRA Section B.1.13.2 states that a fire hose station inspection in 1999 detected a degraded hose station. The hose reel was replaced. Hydrostatic testing and visual inspections of fire hose station equipment in 2004 and 2005 revealed no loss of material. The LRA states that the absence of significant corrosion provides evidence that the program effectively manages loss of material for fire water system components.

The staff did not agree with the applicant that the absence of significant corrosion provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of corrosion.

The LRA states that inspection of fire water storage tank T-107A in 2001 revealed minimal localized leakage, probably due to loss of material on the tank bottom. The leakage is monitored and repair is scheduled. Inspection of fire water storage tank T-107B in 2003 revealed MIC at spots (<1/16-inch in diameter) on internal surfaces similar to corrosion seen prior to tank recoating in 1993. Results of the next inspection (2008) will be compared to 2003 results to determine the need for tank repair. Revelation of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages loss of material for fire water system components.

The LRA states that full-flow tests of fire main segments and hydrant inspections from 2001 through 2004 found no evidence of obstruction or loss of material. Spray and sprinkler system functional tests and visual inspections of piping and nozzles in 2003 found no evidence of blockage or loss of material. The LRA states that the confirmation of absence of degradation provides evidence that the program effectively manages loss of material for fire water system components.

The LRA states that in 2001 an underground fire main broke due to fabrication and installation anomalies. A 16-foot section of the pipe was replaced. Inspection of internal and external surfaces of the removed pipe section revealed only one small spot of corrosion on the external surface where the coating was cracked. The LRA states that the confirmation of absence of degradation provides evidence that the program effectively manages loss of material for fire water system components.

The staff did not agree with the applicant that the absence of degradation provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of degradation.

On July 31, 2003, the staff completed a triennial fire protection team inspection to assess whether the applicant had implemented an adequate fire protection program and established properly maintained post-fire safe shutdown capabilities. Results confirmed that the applicant had maintained the fire protection systems in accordance with their fire protection program, detected program deficiencies, and implemented appropriate corrective actions. The team also evaluated the material condition of selected wet pipe sprinkler systems, standpipe systems, and hose reels and concluded that the applicant had maintained passive features in a state of readiness. A QA audit in May 2004 revealed no issues or findings with impact on program effectiveness to manage loss of material for fire water system components.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.14, the applicant provided the UFSAR supplement for the Fire Water System Program. During the audit and review, the staff noted that the applicant's description of the program in the UFSAR supplement in LRA Appendix A did not include, as commitments, the enhancements described in LRA Section B.1.13.2, "Fire Water System." The staff asked the applicant to include a description of the enhancements to the Fire Water System Program in the UFSAR supplement in LRA Appendix A.

In its response dated September 13, 2006, the applicant revised LRA Section A.2.1.14, "Fire Water System Program," to add, "License renewal commitments 9, 10, and 11 specify enhancements to this program." The staff then determined 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 audit and review of the applicant's Fire Water System Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff reviewed the enhancements and confirmed that their implementation prior to the period of extended operation would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 Metal-Enclosed Bus Inspection Program

Summary of Technical Information in the Application. LRA Section B.1.18, "Metal-Enclosed Bus Inspection," describes the new Metal-Enclosed Bus Inspection Program as consistent, with exceptions, with GALL AMP XI.E4, "Metal Enclosed Bus."

The program will manage the effects of aging on the non-segregated phase bus which connects the 4.16 kV switchgear (A3 through A6) through visual inspection of enclosure assemblies and interior portions of the bus for water or debris. The program will start prior to the period of extended operation.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.12. The staff reviewed the exceptions to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the Metal-Enclosed Bus Inspection Program for which the applicant claims consistency with GALL AMP XI.E4 and found them consistent. Furthermore, the staff concludes that the applicant's Metal-Enclosed Bus Inspection Program provides reasonable assurance that metal-enclosed bus (MEB) aging effects caused by cracked insulation, moisture or debris in the bus enclosure, or loosening of bolted connections will be managed for consistency with CLB during the period of extended operation. The staff finds the applicant's Metal-Enclosed Bus Inspection Program acceptable as consistent with the recommended GALL AMP XI.E4, "Metal-Enclosed Bus," with exceptions as described:

Exception 1. The LRA states an exception to the GALL Report program elements "parameters monitored/inspected" and "detection of aging effects," specifically:

MEB enclosure assemblies will be inspected in addition to internal surfaces.

The LRA states that inspection of MEB enclosures under the Metal-Enclosure Bus Inspection Program assures that effects of aging will be identified before loss of intended functions.

GALL Report Section VI, items VI.A-12 and VI-13, refer to the Structures Monitoring Program for external inspection of the MEB for loss of material due to general corrosion and inspection of the enclosure seals for hardening and loss of strength due to elastomer degradation. In LRA Section B.1.18, the applicant stated that the MEB inspection program attribute would be consistent with that of GALL AMP XI.E4 with an exception to inspect MEB enclosure assemblies in addition to internal surfaces. The staff asked the applicant whether the enclosure seals were within the scope of its MEB inspection program and for the acceptance criterion for the external inspection of enclosure assemblies.

The applicant responded that the MEB program will inspect the enclosure assemblies visually for evidence of loss of material and that enclosure assembly elastomers will be inspected visually and flexed manually.

The acceptance criterion for enclosure assemblies will be no loss of material due to general corrosion. The acceptance criteria for elastomers will be no hardening or loss of strength due to degradation.

The staff finds the applicant's response acceptable because it will inspect MEB externals, including seals, and the inspection acceptance criteria for the external MEB components will be in the plant's basis document (LRPD). The staff verified that the program evaluation report was revised as described. On this basis, the staff finds this exception acceptable.

Exception 2. The LRA states an exception to the GALL Report program element "detection of aging effects," specifically:

> MEB-bolted connections will be visually inspected every 10 years, rather than every 5 years as stated in NUREG-1801.

The LRA states that the GALL Report provides for other inspections a 10-year interval during a 20-year period for two data points which can characterize the degradation rate. This period is adequate to preclude MEB failures as experience shows that aging degradation is a slow process.

GALL AMP XI.E4 states:

> as an alternative to thermography or measuring connection resistance of bolted connections, for the accessible bolted connections that are covered with heat shrink tape, sleeving, insulated boots, etc., the applicant may use visual inspection of insulation material to detect surface anomalies, such as discoloration, cracking, chipping or surface contamination.

When this alternate visual inspection checks bolted connections, the first inspection will be completed before the period of extended operation and every five years thereafter. As it is less effective than testing, this visual inspection will be once every five instead of every ten years.

The LRA states that visual inspection of MEB bolted connections will be every ten years. The staff asked the applicant whether all bolted connections are covered with heat shrink tape, sleeving, or insulated boots and, if so, that the applicant justify the ten-year versus the five-year inspection frequency recommended by GALL AMP XI.E4.

The applicant responded that, because MEB bolted connections are covered with heat shrink tape or insulating boots per the manufacturer's recommendations, a sample of accessible bolted connections will be inspected visually for insulation material surface anomalies. MEB internal portions will be inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. Bus insulation will be inspected for signs of embrittlement, cracking, melting, swelling, or discoloration which may indicate overheating or aging degradation. Internal bus supports will be inspected for structural integrity and signs of cracking. There will be an inspection before the initial 40-year license term and every five years thereafter. If degradation is found in the MEB materials, when the inspection acceptance criteria are not met an engineering evaluation will ensure that MEB intended functions can be maintained consistent with the CLB. The corrective action process includes all elements to be considered, the extent of the concern, the likely causes for not meeting the test acceptance criteria, the corrective action required, and likelihood of recurrence. This engineering evaluation will determine the timing of the next inspection not to exceed 5 years.

In its response dated July 19, 2006, the applicant revised LRA Sections A.2.1.20 and B.1.18 to change the inspection frequency to at least once every five years and to remove the exception to detection of aging effects specifying a ten-year inspection period. With the change of frequency to at least every five years, the applicant is now consistent with the GALL Report and, therefore, the staff finds the removal of this exception acceptable.

Operating Experience. LRA Section B.1.18 states that there is no operating experience for the new Metal-Enclosed Bus Inspection Program.

GALL AMP XI.E4 indicates that operating experience shows that MEB degradation within the scope of GALL AMP XI.E4 is possible. During the Audit and Review the staff requested from the applicant industry and plant-specific operating experience with this program.

The applicant responded that the Metal-Enclosed Bus Inspection Program is new. Plant-specific and industry operating experience will be considered in program development. Industry operating experience that forms the basis for the program is described in the operating experience element of the GALL Report program description. Plant-specific operating experience is consistent with the operating experience in the GALL Report program description.

The applicant's program is based on the program description in the GALL Report, which in turn is based on relevant industry operating experience. As such, operating experience provides reasonable assurance that effects of aging will be managed so components will continue to perform intended functions consistent with the CLB for the period of extended operation. The staff finds the response acceptable because the applicant has reviewed plant-specific operating experience against the industry experience described in the GALL Report. With additional operating experience lessons learned can adjust the program elements.

The staff also reviewed the basis document LRPD-05 to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.20, the applicant provided the UFSAR supplement for the Metal-Enclosed Bus Inspection Program. The staff also reviewed the applicant's operating experience document to confirm that the plant-specific operating experience revealed no degradation not bounded by industry experience.

In a letter dated July 19, 2006, the applicant revised LRA Section A.2.1.20 to change the inspection frequency to at least every five years and listed commitments. Commitment No. 14 states that the applicant will implement the Metal-Enclosed Bus Inspection Program as described in LRA Section B.1.18 before the period of extended operation. The staff then reviewed this section and determined 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 audit and review of the applicant's Metal-Enclosed Bus Inspection Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.13 Oil Analysis Program

Summary of Technical Information in the Application. LRA Section B.1.22, "Oil Analysis," describes the existing Oil Analysis Program as consistent, with exception and enhancements, with GALL AMP XI.M39, "Lubricating Oil Analysis."

The Oil Analysis Program maintains oil systems free of contaminants (primarily water and particulates), preserving an environment not conducive to loss of material, cracking, or fouling. Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.13. The staff reviewed the exception and enhancements to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the Oil Analysis Program for which the applicant claims consistency with GALL AMP XI.M39 and found them consistent. Furthermore, the staff concludes that the applicant's Oil Analysis Program provides reasonable assurance that the effects of aging will be managed so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Oil Analysis Program acceptable as consistent with the recommended GALL AMP XI.M22, "Lubricating Oil Analysis," with an exception and enhancements as described:

Exception. The LRA states an exception to the GALL Report program element "parameters monitored/inspected," specifically:

> Flash point is not determined for sampled oil.

The LRA states that analyses of filter residue or particle count, viscosity, total acid/base (neutralization number), water content, and metals content are sufficient to verify oil suitability for continued use.

During the audit and review, the staff asked the applicant to justify not monitoring the flash point of oil not regularly changed.

The applicant responded that flash point is not determined for sample oil because analysis of filter residue or particle count, viscosity, total acid/base (neutralization number), water content, and metals content are sufficient to verify whether the oil contains water or contaminants that would lead to the onset of aging effects. Also, the applicant stated that monitoring of the percent fuel dilution in diesel engine oils is a more accurate method than flash point for detection of fuel leak and oil dilution. Subsequently, the staff asked the applicant for the method, including any standards, for determining fuel dilution and the acceptance criterion for oil dilution in diesel engine oils.

The applicant responded with a copy of Procedure No. 3.M.3-61.3, "Emergency Diesel Generator Quarterly Preventive Maintenance," showing that quarterly lube oil samples are sent to a laboratory where test results show that percent dilution is measured in accordance with ASTM standards. The acceptance criterion is less than 3 percent by weight and based on ALCO diesel engine owners group chemistry guidelines. The following will be added to the LRA Section B.1.22 exception note: The applicant measures the percent fuel dilution in diesel engine oils, a more accurate method than flash point for detecting fuel leaks and oil dilution.

In its response dated July 19, 2006, the applicant revised the LRA Section B.1.22 exception note to state that it measures the percent fuel dilution in diesel engine oils, a more accurate method than flash point for detecting fuel leak and oil dilution, and the acceptance criterion is less than 3 percent weight based on ALCO diesel engine owners group chemistry guidelines.

On this basis, the staff finds this exception acceptable.

Enhancement 1. The LRA states an enhancement to the GALL Report program element "scope of program," specifically:

> The Oil Analysis Program will be enhanced to periodically change CRD pump lubricating oil. A particle count and check for water will be performed on the drained oil to detect evidence of abnormal wear rates, contamination by moisture, or excessive corrosion.

The LRA states that this enhancement will start before the period of extended operation (Commitment No. 18). This enhancement will verify that the oil environment of the CRD pump is not conducive to loss of material, thus adding assurance that loss of material will be adequately managed.

On this basis, the staff finds the enhancement acceptable because when implemented the Oil Analysis Program will be consistent with GALL AMP XI.M39 and will add assurance of adequate management of aging effects.

Enhancement 2. The LRA states an enhancement to the GALL Report program element "parameters monitored/inspected," specifically:

> Procedures for security diesel and RWCU pump oil changes will be enhanced to obtain oil samples from the drained oil. Procedures for lubricating oil analysis will be enhanced to specify that a particle count and check for water are performed on oil samples from the fire water pump diesel, security diesel, and RWCU pumps.

The LRA states that this enhancement will start before the period of extended operation (Commitment No. 19). This enhancement will verify that the oil environment of the fire water pump diesel, security diesel, and reactor water cleanup pumps will not be conducive to loss of material, thus adding assurance that loss of material will be adequately managed.

On this basis, the staff finds the enhancement acceptable because with the enhancement the Oil Analysis Program will be consistent with GALL AMP XI.M39 and will add assurance of adequate management of aging effects.

Operating Experience. LRA Section B.1.22 states that lube oil analysis for residual heat removal pump B in July 2003 showed viscosity slightly outside the acceptable range and no other problems with the oil. Retest confirmed the viscosity condition. Oil was changed at the next system opportunity. Continuous confirmation of oil quality and timely corrective actions provide evidence that the program effectively manages aging effects for lube oil components. Lube oil testing of the A diesel generator in December 2004 and of the B diesel generator in January 2005 indicated a step change in the wear particle count. Increases in iron and aluminum were very minor and levels remained well below those at which corrective action is necessary. The analysis laboratory indicated that the increases may be the results of new analysis equipment with a higher resolution. Quarterly trending will continue for wear products and appropriate action will be taken if required. Continuous confirmation of oil quality and timely corrective actions provide evidence that the program effectively manages aging effects for lube oil components.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.24, the applicant provided the UFSAR supplement for the Oil Analysis Program. During the audit and review, the staff noted that the description of the program in the UFSAR supplement in LRA Appendix A did not include, as commitments, the enhancements described in LRA Section B.1.22. The staff asked the applicant to include a description of the enhancements to Oil Analysis Program in the UFSAR supplement in LRA Appendix A per SRP-LR Section 3.1.2.4.

In its responses dated September 13 and December 12, 2006, the applicant stated that license renewal Commitment Nos. 18, 19, and 40 specify enhancements to this program. The staff then determined 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 audit and review of the applicant's Oil Analysis Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. Also, the staff reviewed the enhancements and confirmed that their implementation prior to the period of extended operation would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.14 Reactor Head Closure Studs Program

Summary of Technical Information in the Application. LRA Section B.1.25, "Reactor Head Closure Studs," describes the existing Reactor Head Closure Studs Program as consistent, with exception, with GALL AMP XI.M3, "Reactor Head Closure Studs."

This program includes ISI in compliance with the requirements of ASME Code Section XI, Subsection IWB, and preventive measures (*e.g.* rust inhibitors, stable lubricants, appropriate materials) to mitigate cracking and loss of material of reactor head closure studs, nuts, washers, and bushings.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.14. The staff reviewed the exception to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the Reactor Head Closure Studs Program for which the applicant claims consistency with GALL AMP XI.M3 and found them consistent. Furthermore, the staff concludes that the applicant's Reactor Head Closure Studs Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Reactor Head Closure Studs Program acceptable as consistent with the recommended GALL AMP XI.M3, "Reactor Head Closure Studs," with the exception as described:

Exception. The LRA states an exception to the GALL Report program element "detection of aging effects," specifically:

> When reactor head closure studs are removed for examination, either a surface or a volumetric examination is allowed.

The LRA states that cracking initiates on the outside surfaces of bolts and studs; therefore, a qualified surface examination meeting the acceptance standards of ASME Code Section XI, Subsection IWB-3515, has at least the sensitivity for flaw detection that an end-shot ultrasonic examination has for bolts and studs. Thus, when reactor head closure studs are removed for examination, either a surface or volumetric examination is allowed.

During the audit and review, the staff asked the applicant whether the surface examination of the removed reactor head closure studs is with the studs tensioned or untensioned. The staff also asked the applicant whether it there had been any radial ultrasonic scans of its RV closure studs.

The applicant responded with the following statements:

> Since refueling outage 15 (RFO15) (2005), PNPS has adopted the 1998 edition with 2000 addenda of ASME Section XI, which requires either a surface exam or a volumetric exam of RPV studs that are removed. PNPS elected to perform a volumetric examination of these four studs in RFO15 in the tensioned condition prior to their removal. No indications were detected in the four removed studs in 2005. The four studs adjacent to the fuel transfer chute are removed at each refueling outage; these are the only studs that have been removed from the PNPS vessel.
>
> PNPS currently performs ultrasonic examination of RPV studs from the top surface of the stud. In the past, PNPS had performed this examination using a specially fabricated stud radial ultrasonic testing (UT) probe inserted into the stud's heater hole located on the stud's central axis. The technique currently in use, utilizing the flat surface at the top of the stud, is considered superior in detection of flaws in RPV studs when compared to UT exams performed from the heater hole.
>
> RPV studs at PNPS are examined utilizing a straight beam UT technique. This method has been demonstrated and qualified by the Performance Demonstration Initiative (PDI) at the EPRI NDE Center. Examiners utilizing this qualified technique are also qualified by the PDI to perform this examination. This straight beam examination has been demonstrated by PDI to be capable of detecting a flaw of critical size. All 56 RPV studs at PNPS are examined once per interval using this technique.

The staff reviewed the ASME Code Section XI requirements for Examination Category B-G-1, "pressure retaining bolting," in the 1995 Code Edition, to which GALL Report Revision 0 refers, and in the 2001 Code Edition, to which GALL Report Revision 1 refers. The staff noted that code examination requirements were changed from the earlier to the more recent code edition and that the 2001 code edition with 2002 and 2003 addenda to which the current GALL Report revision refers no longer requires both surface and volumetric examination of RV closure studs when removed.

On the basis that either surface or volumetric examination of RV closure studs (when removed) is consistent with the ASME Code Section XI edition and addenda to which GALL Report Revision 1 refers, the staff finds the exception acceptable.

Operating Experience. LRA Section B.1.25 states that volumetric examination of 18 reactor head closure studs and visual examination of 18 nuts and 18 washers during RFO 15 (April 2005) revealed no new recordable indications. The LRA states that the absence of new recordable indications provides evidence that the program effectively manages loss of material and cracking of the reactor head closure studs, nuts, washers, and bushings.

The staff did not agree with the applicant that the absence of new recordable indications provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of new recordable indications.

The project team reviewed the operating experience provided in the PNPS LRA 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 addition, the project team reviewed PNPS operating experience, as documented in the PNPS License Renewal Project Operating Experience Review Report for the Reactor Head Closure Studs Program, and did not find any evidence of PNPS equipment degradation or failures that are outside the envelope of industry experience.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.27, the applicant provided the UFSAR supplement for the Reactor Head Closure Studs Program. The staff reviewed this section and determined 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 audit and review of the applicant's Reactor Head Closure Studs Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.15 Reactor Vessel Surveillance Program

Summary of Technical Information in the Application. LRA Section B.1.26, "Reactor Vessel Surveillance," describes the existing Reactor Vessel Surveillance Program as consistent, with enhancement, with GALL AMP XI.M31, "Reactor Vessel Surveillance."

This program manages reduction in fracture toughness of reactor vessel beltline materials to maintain the pressure boundary function of the RPV for the period of extended operation. This program monitors changes in the fracture toughness properties of ferritic materials in the RPV beltline region. As BWRVIP-ISP capsule test reports become available for representative RPV materials the actual shift in the reference temperature for nil-ductility transition of the vessel material may be updated. In accordance with 10 CFR Part 50, Appendices G and H, the applicant reviews relevant test reports to comply with fracture toughness requirements and P-T limits.

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 remained adequate to manage the aging effects for which it is credited.

The applicant has implemented the BWRVIP ISP based on BWRVIP-78 Report, "BWR Integrated Surveillance Program Plan," and BWRVIP-86-A Report, "BWR Vessel and Internals Project, BWR Integrated Surveillance Program Implementation." These reports are consistent with GALL AMP XI.M31, "Reactor Vessel Surveillance," for the period of the current operating license. The staff concludes that the BWRVIP ISP in BWRVIP-78 and BWRVIP-86-A Reports are acceptable for BWR applicant implementation provided that all participating applicants use one or more compatible neutron fluence methodologies acceptable to the staff for determining surveillance capsule and RPV neutron fluences. The BWRVIP developed an updated ISP version in the BWRVIP-116 Report, "BWR Vessel And Internals Project, Integrated Surveillance Program Implementation For License Renewal," with ISP guidelines for monitoring neutron irradiation embrittlement of the RPV beltline materials for all BWR power plants for license renewal periods. The applicant stated in LRA Sections B.1.26 and A.2.1.28, that it will implement the ISP specified in the BWRVIP-116 Report. The staff reviewed UFSAR Section A.2.1.28 to determine whether it adequately describes the program.

The staff's review of LRA Section 3.1.2.1 identified areas in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAIs as discussed below.

In RAI B.1.26-1 dated July 31, 2006, the staff requested that the applicant include in LRA Sections B.1.26 and A.2.1.28 the following statement:

> The BWRVIP-116 Report which was approved by the staff will be implemented at PNPS with the conditions documented in Sections 3 and 4 of the staff's final SE dated March 1, 2006, for the BWRVIP-116 Report.

In its response dated August 30, 2006, the applicant stated that it had revised LRA Sections A.2.1.28 and B.1.26 as requested.

Based on its review, the staff finds the applicant's response to RAI B.1.26-1 acceptable and, therefore, its concern described in RAI B.1.26-1 is resolved.

Part 50 of 10 CFR, Appendix H, requires that an integrated surveillance program (ISP) basis for an RPV surveillance program be approved by the staff. The applicant's ISP was developed by the BWRVIP and the applicant will apply the BWRVIP ISP as the method by which it will comply with 10 CFR Part 50, Appendix H. The BWRVIP ISP indicates capsules that must be tested to monitor neutron radiation embrittlement for all participating applicants and capsules that need not be tested (*i.e.*, standby capsules). BWRVIP-116 Report, Table 3-3, indicates that the remaining PNPS capsule is not to be tested. This untested capsule was originally part of the applicant's plant-specific surveillance program and has received significant amounts of neutron radiation.

In RAI B.1.26-2 dated July 31, 2006, the staff requested that the applicant include in LRA Sections B.1.26 and A.2.1.28 the following statement:

> If the PNPS standby capsule is removed from the RPV without the intent to test it, the capsule will be stored in manner which maintains it in a condition that would permit its future use, including during the period of extended operation, if necessary.

In its response dated August 30, 2006, the applicant stated that it had revised LRA Sections A.2.1.28 and B.1.26.

Based on its review, the staff finds the applicant's response to RAI B.1.26-2 acceptable and, therefore, its concern described in RAI B.1.26-2 is resolved. However, based on the concern raised in Section 4.2.1 regarding the acceptability of the applicant's RPV neutron fluence evaluations, the staff concluded that the review of LRA Section B.1.26 could not be completed and that the review would be completed in parallel with the review of the revised LRA Section 4.2.1. This was identified as OI 4.2. in the SER with OI issued in March 2007.

In a letter dated May 17, 2007, the applicant stated that it had re-evaluated the neutron embrittlement issues addressed in Sections 4.2, and concluded that changes to the fluence extrapolation do not affect the requirements specified in AMP B.1.26. The staff finds the applicant's conclusion acceptable because changes to the fluence extrapolation cause no change in the requirements specified in ISP, specifically, the withdrawal schedule of the surveillance capsules. Therefore, the staff's concern related to OI 4.2 is resolved and OI 4.2 is closed.

Operating Experience. LRA Section B.1.26 states that the applicant participates in the BWRVIP ISP as approved in an operating license amendment dated January 5, 2005. Participation in the BWRVIP ISP ensures that future operating experience from all participating BWRs will be factored into 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.2.1.28, the applicant provided the UFSAR supplement for the Reactor Vessel Surveillance Program describing it as an existing program periodically testing metallurgical surveillance samples to monitor the loss of fracture toughness of the RPV beltline region materials consistent with the requirements of 10 CFR Part 50, Appendix H. The applicant further stated that it will implement the staff-approved BWRVIP-116 Report for the license renewal period (Commitment No. 22). As described in the staff evaluation section, the applicant made a commitment to include the following statement in LRA Section A.2.1.28:

> The BWRVIP-116 Report which was approved by the staff will be implemented at PNPS with the conditions documented in Sections 3 and 4 of the staff's final SE dated March 1, 2006, for the BWRVIP-116 Report.

As to the status of the remaining standby capsule, the applicant made a commitment to incorporate the following statement in LRA Section A.2.1.28:

> If the PNPS standby capsule is removed from the reactor vessel without the intent to test it, the capsule will be stored in a manner which would permit its future use, if necessary.

The staff reviewed the proposed revision to LRA Section A.2.1.28 and determined that by implementing the most recent staff-approved version of the BWRVIP-116 Report, the applicant demonstrated compliance with 10 CFR Part 50, Appendix H.

The staff's review determined that the following license condition is required to ensure that withdrawal schedule changes for the capsule specified in the BWRVIP-116 Report will be submitted for staff review and approval:

> All capsules placed in storage must be maintained for future insertion. Any changes to storage requirements must be approved by the NRC, as required by 10 CFR Part 50, Appendix H.

The staff reviewed this section and determined that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d). However, based on the concern raised in Section 4.2.1 regarding the acceptability of the applicant's RPV neutron fluence evaluations, the staff has concluded that the review of LRA Section B.1.26 could not be completed and that the review would be completed in parallel with the review of the revised LRA Section 4.2.1. This was identified as OI 4.2. in the SER with OI issued in March 2007.

In a letter dated May 17, 2007, the applicant stated that it had re-evaluated the neutron embrittlement issues addressed in Sections 4.2, and concluded that changes to the fluence extrapolation do not affect the requirements specified in AMP B.1.26. The staff finds the applicant's conclusion acceptable because changes to the fluence extrapolation cause no change in the requirements specified in ISP, specifically, the withdrawal schedule of the surveillance capsules. Therefore, the staff's concern related to the OI 4.2 is resolved and OI 4.2 is closed.

Conclusion. On the basis of its audit and review of the applicant's Reactor Vessel Surveillance Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that their implementation prior to the period of extended operation would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 A.2.1.28 for this AMP and concludes that it provides (pending incorporation of the applicant's commitments) an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.16 Service Water Integrity Program

Summary of Technical Information in the Application. LRA Section B.1.28, "Service Water Integrity," describes the existing Service Water Integrity Program as consistent, with exceptions, with GALL AMP XI.M20, "Open-Cycle Cooling Water System."

This program relies on implementation of the recommendations of GL 89-13 to manage the effects of aging on the SSW system for the period of extended operation. The program includes surveillance and control techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the SSW system or structures and components it services.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.16. The staff reviewed the exceptions to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the Service Water Integrity Program for which the applicant claims consistency with GALL AMP XI.M20 and found them consistent. Furthermore, the staff concludes that the applicant's Service Water Integrity Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Service Water Integrity Program acceptable as consistent with the recommended GALL AMP XI.M20, "Service Water Integrity," with exceptions as described:

Exception 1. The LRA states an exception to the GALL Report program element "preventive actions," specifically:

> NUREG-1801 states that system components are lined or coated. Components are lined or coated only where necessary to protect the underlying metal surfaces.

The LRA states that the GALL Report states that system components are constructed of appropriate materials and lined or coated to protect the underlying metal surfaces from exposure to aggressive cooling water environments. Not all system components are lined or coated, only where necessary to protect the underlying metal surfaces.

During the audit and review, the staff asked the applicant for applications in which components are not coated or lined and the materials of construction.

The applicant responded that the SSW supply piping is constructed of titanium, a material which has shown excellent corrosion resistance in this environment. The other components in the SSW supply are small-bore piping for vents and drains, pump and valve bodies, and heat exchanger tubes. All of these components are constructed of copper alloys with demonstrated good corrosion resistance in this environment and operating experience shows that the Service Water Integrity Program manages loss of material and takes corrective action before loss of component intended functions.

On this basis, the staff finds the exception acceptable.

Exception 2. The LRA states an exception to the GALL Report program element "monitoring and trending," specifically:

> NUREG-1801 states that testing and inspections are performed annually and during RFOs. The PNPS program requires tests and inspections during each RFO.

The LRA states that the GALL Report program entails testing and inspections annually and during RFOs. The applicant's program requires tests and inspections during each RFO but not annually. As aging effects typically are manifested over several years, the difference in inspection and testing frequency is insignificant.

During the audit and review, the staff evaluated the applicant's inspection interval and agreed that adverse conditions caused by the aging effects in the service water systems manifest over several years. Operating experience shows that a two-year interval has not led to adverse service water system operating conditions; therefore, the difference between a one-year and two-year inspection and testing frequency is insignificant.

On this basis, the staff finds the exception acceptable.

In addition, the applicant stated that it will enhance this program to clarify the procedures for trending heat transfer test results (Commitment No. 24). The staff finds this acceptable.

Operating Experience. LRA Section B.1.28 states that results of heat transfer capability testing of the reactor building closed cooling water (RBCCW) heat exchangers from 2001 through 2004 show that the heat exchangers can remove the required amount of heat. Confirmation of adequate heat removal provides evidence that the program effectively manages fouling of SSW-cooled heat exchangers.

Results of SSW visual inspections, eddy current testing, UT, and radiography testing from 1998 through 2004 revealed areas of erosion and corrosion on internal and external surfaces. SSW butterfly valves, pump discharge check valves, air removal valves, and pipe spools have been replaced with components made of corrosion-resistant materials, RBCCW heat exchanger channel assemblies have been replaced, and tubes have been sleeved to address erosion and corrosion. Revelation of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages loss of material for SSW system components.

Visual inspections of SSW piping revealed degradation of the lining in original SSW carbon steel rubber-lined piping intended to protect pipe internal surfaces from erosion and corrosion. Therefore, SSW piping has been replaced with carbon steel pipe with rubber lining cured in place, relined with a ceramic epoxy compound, or replaced with titanium pipe. Revelation of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages loss of material for SSW system components.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.30, the applicant provided the UFSAR supplement for the Service Water Integrity Program. The staff reviewed this section and determined 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 audit and review of the applicant's Service Water Integrity Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.17 Structures Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.29.2, "Structures Monitoring," describes the existing Structures Monitoring Program as consistent, with enhancements, with GALL AMP XI.S6, "Structures Monitoring Program."

Structures monitoring in accordance with 10 CFR 50.65 (Maintenance Rule) is addressed in Regulatory Guide 1.160 and Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants 93-01. These two documents guide development of licensee-specific programs to monitor the condition of structures and structural components within the scope of the Maintenance Rule so there is no loss of structure or structural component intended function. As protective coatings are not relied upon to manage aging effects for structures in the Structures Monitoring Program, the program does not address protective coating monitoring and maintenance.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.17. The staff reviewed the enhancements to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the Structures Monitoring Program for which the applicant claims consistency with GALL AMP XI.S6 and found them consistent. Furthermore, the staff concludes that the applicant's Structures Monitoring Program provides reasonable assurance of adequate management of aging effects to maintain intended functions during the period of extended operation. The staff finds the applicant's Structures Monitoring Program acceptable as consistent with the recommended GALL AMP XI.S6, "Structures Monitoring Program," with enhancements as described:

Enhancement 1. The LRA states an enhancement to the GALL Report program element "scope of program," specifically:

> The Structures Monitoring Program procedure will be enhanced to clarify that the discharge structure, security diesel generator building, trenches, valve pits, manholes, duct banks, underground fuel oil tank foundations, manway seals and gaskets, hatch seals and gaskets, underwater concrete in the intake structure, and crane rails and girders are included in the program.

The LRA states that the Structures Monitoring Program is comparable to the program described in the GALL Report, Section XI.S6, "Structures Monitoring Program." The Structures Monitoring Program will be enhanced to clarify that the discharge structure, security diesel generator building, trenches, valve pits, manholes, duct banks, underground fuel oil tank foundations, manway seals and gaskets, hatch seal and gaskets, underwater concrete in the intake structure, and crane rails and girders are included. The structures, structural components, and their AERMs under the scope of the Structures Monitoring Program are shown in LRA Tables 3.5.2-1 through 3.5.2-6. Visual inspections of accessible plant structures are at three-year intervals and inspections of normally inaccessible (insulated or high-radiation zone) areas are at ten-year intervals. Visual inspections of buried plant structures are opportunistic when excavation occurs; however, more frequent inspections may be based on past inspection results, industry experience, or exposure to a significant event (*e.g.*, tornado, earthquake, fire, or chemical spill).

On this basis, the staff finds the enhancement (Commitment No. 25) acceptable because when implemented the Structures Monitoring Program will be consistent with GALL AMP XI.S6 and will add assurance of adequate management of aging effects.

Enhancement 2. The LRA states an enhancement (Commitment No. 26) to the GALL Report program element "detection of aging effects," specifically:

> Guidance for performing structural examinations of elastomers (seals, gaskets, seismic joint filler, and roof elastomers) to identify cracking and change in material properties will be added to the Structures Monitoring Program procedure.

The LRA states that cracks, gaps, and corrosion will be monitored as stated in the program evaluation report and Attachment 4, "Structures Monitoring Program General Criteria." For concrete, the Structures Monitoring Program manages loss of material, cracking, and change in material properties as shown in LRA Tables 3.5.2-1 through 3.5.2-6. The acceptance criteria are the absence of cracks, excessive rust bleeding, staining or discoloration, abrasion, erosion, cavitation, spalling, scaling, leaching, excessive settlement, corrosion of reinforcing, and degraded waterproof membranes. For steel, the Structures Monitoring Program manages the loss of material as shown in LRA Tables 3.5.2-1 through 3.5.2-6. The acceptance criteria are the absence of pitting, beam/column deflection, cracks, flaking coatings, excessive rust, loose/missing bolts, peeling paint, and widespread corrosion. For elastomers, the aging effects managed are cracking and change in material properties. Acceptance criteria are the absence of cracks and gaps.

On this basis, the staff finds the enhancement acceptable because when implemented the Structures Monitoring Program will be consistent with GALL AMP XI.S6 and will add assurance of adequate management of aging effects.

The staff asked the applicant whether it intends to inspect inaccessible areas that may be exposed by excavation, whether the environment is aggressive, and whether it intends to inspect inaccessible areas if degradation is observed in accessible areas exposed to the same environment.

The applicant responded that its site procedure will be enhanced to require opportunistic inspections of inaccessible concrete areas when they become accessible. In a letter dated September 13, 2006, the applicant added this enhancement to Commitment No. 25, which includes Enhancement 1. The staff finds this addition of opportunistic inspections acceptable.

In its response, the applicant also stated that expanding inspection where significant concrete degradation is observed in accessible areas will continue to be part of its corrective action program as shown in LRA Section B.0.3. The staff finds this response acceptable because the corrective action program will address expansion of scope when significant degradation is observed

Operating Experience. LRA Section B.1.29.2 states that inspections of structural steel, concrete exposed to fluid, and structural elastomers from 1998 through 2004 revealed cracks, gaps, corrosion (rust), flaking coatings as signs of degradation. Revelation of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects for structural components. Structural inspection of pipe supports and cable trays in November 2004 revealed numerous minor signs of degradation which was repaired. Revelation of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects for structural components. A self-assessment in July 2005 revealed no issues or findings with impact on program effectiveness.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.32, the applicant provided the UFSAR supplement for the Structures Monitoring Program. In a letter dated September 13, 2006, the applicant revised LRA Section A.2.1.32, Structures Monitoring Program, to add include Commitments Nos. 25 and 26 specify enhancements to this program. The staff then determined 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 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 confirmed that their implementation prior to the period of extended operation would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.18 Water Control Structures Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.29.3, "Water Control Structures Monitoring," describes the existing Water Control Structures Monitoring Program as consistent, with enhancement, with GALL AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants."

The program visually inspects water-control structures (breakwaters, jetties, and revetments) to manage loss of material and loss of form. The water-control structures are of rubble mound construction with the outer layer protected by heavy capstone. Parameters monitored are settlement (vertical displacement) and rock displacement.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.18. The staff reviewed the enhancement to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the Water Control Structures Monitoring Program for which the applicant claims consistency with GALL AMP XI.S7 and found the program comparable to that described in the GALL Report, Section XI.S7, RG 1.127, "Inspection of Water Control Structures Associated with Nuclear Power Plants." The program visually inspects water control structures (breakwaters, jetties, and revetments) to manage loss of material and loss of form. The water control structures are of rubble mound construction with the outer layer protected by heavy capstone. Parameters monitored include settlement (vertical displacement) and rock displacement. These parameters are consistent with those described in RG 1.127. There are no underwater supports within the scope of this program. Visual inspections of water control structures are at least every five years and following major storms (AMPER, LRPD-02, Section 4.21.3.4(b)) consistent with the GALL Report. Furthermore, the staff concludes that the applicant's Water Control Structures Monitoring Program provides reasonable assurance that aging effects will be adequately managed to maintain intended functions during the period of extended operation. The staff finds the applicant's Water Control Structures Monitoring Program acceptable as consistent with the recommended GALL AMP XI.S7, RG 1.127, "Inspection of Water Control Structures Associated with Nuclear Power Plants," with the enhancement as described:

Enhancement. The LRA states an enhancement (Commitment No. 27) to the GALL Report program element "scope of program," specifically:

> Program scope will be enhanced to include the east breakwater, jetties and onshore revetments in addition to the main breakwater.

The LRA states that the Water Control Structures Monitoring Program at PNPS is comparable to the program described in GALL Report, Section XI.S7, RG 1.127, "Inspection of Water Control Structures Associated with Nuclear Power Plants." The program visually inspects water control structures (breakwaters, jetties, and revetments) to manage loss of material and loss of form. The water control structures are of rubble mound construction with the outer layer protected by heavy capstone. The parameters monitored include settlement and are consistent with those described in RG 1.127. There are no underwater supports within the scope of this program; however, the program scope will be enhanced to include the east breakwater, jetties, and onshore revetments in addition to the main breakwater.

On this basis, the staff finds the enhancement acceptable because when implemented the Water Control Structures Monitoring Program will be consistent with GALL AMP XI.S7 and will add assurance of adequate management of aging effects.

Operating Experience. LRA Section B.1.29.3 states that preliminary results of the 2004 inspection of the main breakwater detected one area of the breakwater had rock displacement completely dislodging the rocks on the shore side of the main breakwater. The dislodgement extended beyond the façade but not to the full height or width of the water-control structure. An evaluation to determine whether repair was required to restore design stability showed no impact on design stability; however, a work request was issued to repair the structure due to the possibility that storms might extend the damaged areas and restrict personnel from easily walking on it. Detection of displacement and corrective action prior to loss of intended function provide evidence that the program effectively manages loss of material and loss of form for water-control structures.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.33, the applicant provided the UFSAR supplement for the Water Control Structures Monitoring Program. In a letter dated September 13, 2006, the applicant revised LRA Section A.2.1.32, Structures Monitoring – Structures Monitoring Program, to include Commitment No. 27 to specify enhancement to this program. The staff then determined 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 audit and review of the applicant's Water Control 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 enhancement and confirmed that its implementation prior to the period of extended operation would make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.19 Water Chemistry Control - Closed Cooling Water Program

Summary of Technical Information in the Application. LRA Section B.1.32.3, "Water Chemistry Control - Closed Cooling Water," describes the existing Water Chemistry Control - Closed Cooling Water Program as consistent, with exception, with GALL AMP XI.M21, "Closed-Cycle Cooling Water System."

This program includes preventive measures that manage loss of material, cracking, and fouling for components in closed cooling water (CCW) systems (reactor building closed cooling water, turbine building closed cooling water (TBCCW), EDG cooling water, SBO diesel cooling water, security diesel generator cooling water, and plant heating). These chemistry activities monitor and control CCW chemistry by procedures and processes based on EPRI guidance.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in Audit and Review Report Section 3.0.3.2.19. The staff reviewed the exception to determine whether the AMP remained adequate to manage the aging effects for which it is credited.

The staff noted that the exception taken for Element 4, "Detection of Aging Effects," for performance and functional testing also should have been taken for Element 3, "Parameters Monitored/Inspected," for the same reason. The staff asked the applicant to justify not taking this exception to Element 3.

The applicant responded that the exception in LRA Section B.1.32.3 to the "detection of aging effects" program element, applies equally to the "parameters monitored/trended" program element. The exception was to Element 4 because it relates more directly to detection of aging effects; however, LRA Section B.1.32.3 will be amended to indicate that the exception is to both the "parameters monitored/trended" and "detection of aging effects" program elements.

In its response dated July 19, 2006, the applicant revised LRA Section B.1.32.3 to state the exception to both Element 3, "Parameters Monitored/Trended," and Element 4, "Detection of Aging Effects."

The GALL Report recommends that for "susceptible locations" a one-time inspection verification program may be appropriate. The staff asked the applicant if it intended to implement a one-time inspection for this water chemistry control program and, if so, why the one-time inspection was not included in the UFSAR supplement Appendix A for this program.

The applicant responded that the One-Time Inspection Program described in LRA Section B.1.23 includes inspections to verify the effectiveness of the water chemistry control AMPs by confirming that unacceptable cracking, loss of material, and fouling has not occurred. Discussions in LRA Section 3, Table 1, link the One-Time Inspection Program and Water

Chemistry Control Program for susceptible components; however, for clarity, LRA Appendix A descriptions for the Water Chemistry Control – Closed Cooling Water Program will be amended by a link to One-Time Inspection Program activities to confirm the effectiveness of these programs.

In its response dated July 19, 2006, the applicant stated that the effectiveness of the Water Chemistry Control – Auxiliary Systems, BWR, and Closed Cooling Water Programs is confirmed by the One-Time Inspection Program. For further clarification, the applicant revised LRA Appendix A for these three water chemistry control programs to include the following sentence: "The One-Time Inspection Program will confirm the effectiveness of the program."

Based on these changes to LRA Appendix A, the applicant's response is acceptable.

The staff reviewed those portions of the Water Chemistry Control – Closed Cooling Water Program for which the applicant claims consistency with GALL AMP XI.M21 and found them consistent. Furthermore, the staff concludes that the applicant's Water Chemistry Control – Closed Cooling Water Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Water Chemistry Control – Closed Cooling Water Program acceptable as consistent with the recommended GALL AMP XI.M21, "Closed-Cycle Cooling Water System," with the exception as described:

Exception. The LRA states an exception to the GALL Report program element "detection of aging effects," specifically:

> The PNPS Water Chemistry Control – Closed Cooling Water Program does not include performance and functional testing.

The LRA states that although GALL Report, Revision 1, Section XI.M21, "Closed-Cycle Cooling Water System," endorses EPRI Report TR-107396 for performance and functional testing guidance, EPRI Report TR-107396 does not recommend equipment performance and functional testing as parts of a water chemistry control program. This statement appears appropriate because monitoring pump performance parameters is of little value in managing effects of aging on long-lived, passive CCW system components. Rather, EPRI Report TR-107396 states in Section 5.7 (Section 8.4 in EPRI report 1007820) that performance monitoring typically is part of an engineering program, not part of water chemistry. In most cases, functional and performance testing verify whether component active functions can be accomplished and would be included as part of the Maintenance Rule (10 CFR 50.65). Passive intended functions of pumps, heat exchangers, and other components will be adequately managed by the CCW Chemistry Program through monitoring and control of water chemistry parameters.

The staff reviewed EPRI Report TR-107396 and agreed that it does not recommend performance and functional testing as parts of the water chemistry control program. This testing could be part of another program. Usually, the Maintenance Rule dictates the requirements of performance and functional testing; however, the last sentence of the applicant's justification stated that the passive intended functions were adequately managed by the CCW Chemistry Control Program through monitoring and control of water chemistry. The staff asked the applicant whether the One-Time Inspection Program also verified the effectiveness of the chemistry program and, if so, whether it should be part of the exception justification.

In its response dated July 19, 2006, the applicant revised LRA Section B.1.32.3, Exception Note 1, as follows:

> Passive intended functions of pumps, heat exchangers, and other components will be adequately managed by the Closed Cooling Water Chemistry and One-Time Inspection Programs through monitoring and control of water chemistry parameters and verification of the absence of aging effects.

On this basis, the staff finds the applicant's response and the exception acceptable.

Operating Experience. LRA Section B.1.32.3 states that from 1998 through 2004 there were several condition reports of adverse trends in parameters (nitrite and tolytriazole) monitored by the Water Chemistry Control – Closed Cooling Water Program and actions taken within the corrective action program to preclude unacceptable values. No increases, long- or short-term, were observed in iron or copper levels. The applicant also dealt with two condition reports of parameters monitored by the Water Chemistry Control – Closed Cooling Water Program outside administrative limits but still within EPRI acceptance criteria. Additionally, the applicant found a few incidents in which station heating system parameters monitored by the Water Chemistry Control - Closed Cooling Water Program were outside EPRI action Level 1 acceptance criteria, increased monitoring frequency, and returned the parameter to within the prescribed normal operating range as soon as possible. Continuous confirmation of water quality and timely corrective action provide evidence that the program effectively manages component aging effects.

The LRA states that QA audits in 2000 and 2002 revealed no issues or findings with impact on program effectiveness. A self-assessment in October 2003 noted that chemistry specifications and control methods were not established clearly for nonsafety-related diesel jacket coolant systems. This assessment and a QA audit in early 2004 revealed that corrective actions for condition reports addressing CCW analyses had not been completed on time. Specifically, there were condition reports in early 2003 that for RBCCW, TBCCW, and plant heating some chemical analyses had not been as frequent as per procedures due to faulty analysis equipment. In June 2004 corrective actions had not been completed. Corrective actions taken by the end of 2004 reinstated all analyses and confirmed water quality for the RBCCW, TBCCW, and plant heating systems. Completion of corrective actions and confirmation of water quality provide evidence that the program effectively manages component aging effects.

The LRA states that when the revised EPRI CCW guidelines first were implemented (January 2005), new jacket coolant chemistry parameters did not meet recommendations for the EDG, SBO, and security diesels, indicating that the glycol and corrosion inhibitor products in the jacket cooling water systems had degraded and become less effective. An evaluation found no immediate concerns of corrosion or cooling ability breakdown for the diesels as other parameters routinely analyzed were within specifications with no adverse trend indicating immediate need for action. Work requests were issued to change the SBO and security diesel cooling water during the next maintenance opportunity. An evaluation determined that an EDG jacket coolant change-out was not warranted. Continuous confirmation of water quality and timely corrective action provide evidence that the program effectively manages component aging effects. A self-assessment of the Water Chemistry Control - Closed Cooling Water Program in August 2005 of how well the program implemented the revised EPRI CCW guidelines concluded that problems remain on achievable limits for the security diesel tolytriazole and the EDG and

SBO diesel reserve alkalinity.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.38, the applicant provided the UFSAR supplement for the Water Chemistry Control - Closed Cooling Water Program.

In a letter dated July 19, 2006, the applicant stated that the effectiveness of the Water Chemistry Control – Auxiliary Systems, BWR, and Closed Cooling Water Programs is confirmed by the One-Time Inspection Program. For further clarification, LRA Appendix A is revised for these three water chemistry control programs to include the following sentence: "The One-Time Inspection Program" will confirm the effectiveness of the program.

The staff reviewed this section and determined 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 audit and review of the applicant's Water Chemistry Control - Closed Cooling Water Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.20 Bolting Integrity Program

Summary of Technical Information in the Application. In LRA Amendment 5, dated July 19, 2006, the applicant submitted Section B.1.33, Appendix B, and stated that the new "Bolting Integrity Program" is consistent with GALL AMP XI.M18, "Bolting Integrity," with an enhancement.

This program relies on recommendations for a comprehensive bolting integrity program as in NUREG-1339 and industry recommendations as in EPRI NP-5769 with the exceptions noted in NUREG-1339 for safety-related bolting. The program relies on industry recommendations for comprehensive bolting maintenance as in EPRI TR-104213 for pressure-retaining bolting and structural bolting.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report and documented a detailed audit evaluation of this AMP in SER Section 3.0.3.2.20. The staff reviewed the enhancement to determine whether the

AMP remained adequate to manage the aging effects for which it is credited.

The staff reviewed those portions of the Bolting Integrity Program for which the applicant claims consistency with GALL AMP XI.M18 and found them consistent. Furthermore, the staff concludes that the applicant's Bolting Integrity Program reasonably assures management of aging effects so components crediting this program can perform intended functions consistent with the CLB during the period of extended operation. The staff finds the applicant's Bolting Integrity Program acceptable as consistent with the recommended GALL AMP XI.M18, "Bolting Integrity," with the enhancements as described:

Enhancement. The LRA states an enhancement to the GALL Report program element "preventive actions," specifically:

> Enhance procedures to verify gasket compression if applicable following assembly. Enhance procedures to clarify that actual yield strength is used in selecting materials for low susceptibility to SCC and to clarify the prohibition on the use of lubricants containing MoS_2 for bolting at PNPS.

The staff finds this enhancement acceptable because when implemented, the Bolting Integrity Program will be consistent with GALL AMP XI.M18 and will add assurance of adequate management of aging effects.

Operating Experience. LRA Section B.1.33 states that operating experience reviews did not indicate cracking or loss of preload as AERMs for pressure boundary bolting. Although cracking and loss of preload are not AERMs for the period of extended operation, plant procedures implement the recommendations of NUREG-1339, "Resolution to Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," for pressure boundary bolting within the scope of license renewal. Plant procedures address material and lubricant selection, design standards, and good bolting maintenance practices in accordance with EPRI 5067, "Good Bolting Practices."

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm 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 SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Amendment 5, dated July 19, 2006, the applicant submitted Section A.2.1.39, the UFSAR supplement for the Bolting Integrity Program. The staff reviewed this section and determined 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 No. 32) to implement this program before the period of extended operation.

Conclusion. On the basis of its audit and review of the applicant's Bolting Integrity Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancement, and determines that the AMP, with the enhancement, is adequate to manage the aging effects for which it is credited. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs Not Consistent with or Not Addressed in the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as plant-specific:

- Heat Exchanger Monitoring Program
- Containment Inservice Inspection Program
- Inservice Inspection Program
- Instrument Air Quality Program
- Periodic Surveillance and Preventive Maintenance Program
- Water Chemistry Control - Auxiliary Systems Program
- Bolted Cable Connection Program

For AMPs not consistent with or not addressed in the GALL Report the staff performed a complete review to determine their adequacy to monitor or manage aging. The staff's review of these plant-specific AMPs is documented in the following sections.

3.0.3.3.1 Heat Exchanger Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.15, "Heat Exchanger Monitoring," describes the new Heat Exchanger Monitoring Program as a plant-specific program.

The Heat Exchanger Monitoring Program will inspect heat exchangers for degradation and, if found, evaluate its effects on the heat exchanger's design functions, including its ability to withstand a seismic event. Representative tubes within a sample of heat exchangers will be eddy current-tested at a frequency determined by plant-specific and industry operating experience for aging effects prior to loss of intended function. With each eddy current test, visual inspections on accessible heat exchanger heads, covers, and tube sheets will monitor surface condition for indications of loss of material. The sample of heat exchangers includes the residual heat removal heat exchangers, core spray pump motor thrust bearing lube oil coolers, high-pressure coolant injection gland seal condenser, high-pressure coolant injection turbine lube oil cooler, reactor core isolation coolant lube oil cooler, recirculation pump motor generator set fluid coupling oil and bearing coolers, CRD pump oil coolers, recirculation pump motor lube oil coolers, clean-up recirculation pump lube oil coolers and stuffing box cooler, and EDG lube oil coolers. The program will start prior to the period of extended operation.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B.1.2 on the applicant's demonstration of the Heat Exchanger Monitoring Program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff reviewed the Heat Exchanger Monitoring Program against the AMP elements found in the GALL Report, 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 applicant indicated that the "corrective actions," "confirmation process," and "administrative controls" program elements 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:

(1) Scope of Program - LRA Section B.1.15 states that this program will manage the effects of aging on selected heat exchangers in various systems as indicated in AMRs.

The staff confirmed that the "scope of the program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

(2) Preventive Actions - LRA Section B.1.15 states that this inspection program takes no actions to prevent degradation.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable.

(3) Parameters Monitored or Inspected - LRA Section B.1.15 states that, where practical, eddy current inspections of shell-and-tube heat exchanger tubes will determine tube wall thickness. Visual inspections on heat exchanger heads, covers, and tube sheets where accessible will monitor surface condition for indications of loss of material.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

(4) Detection of Aging Effects - LRA Section B.1.15 states that this program manages the aging effect of loss of material. Representative tubes within the sample of heat exchangers will be eddy current tested at a frequency determined by plant-specific and industry operating experience to detect effects of aging before loss of intended function. Visual inspections of accessible heat exchangers will be at the same frequency as eddy current inspections.

An appropriate sample of heat exchangers will be determined based on operating experience before inspections. Inspection can reveal loss of material that could cause degradation of the heat exchangers. Fouling is not addressed by this program.

However, the staff noted that there were no provisions to detect localized (*e.g.*, MIC and crevice) corrosion. The applicant was asked for the method(s) for detecting localized corrosion and determining areas to be inspected and frequency of inspections for it.

The applicant responded that this program is new and the details are not yet developed. In accordance with the program evaluation report, where practical, eddy current inspections of shell-and-tube heat exchanger tubes will be used to determine tube wall thickness. Visual inspections will be on heat exchanger heads, covers, and tube sheets where accessible to monitor surface conditions for indications of loss of material where localized corrosion could occur (*i.e.*, stagnant or low-flow areas). An approach for determining inspection frequency would be that the initial inspection results would determine the frequency to detect effects of aging before loss of intended function. Inspection frequency will depend on the specific component operating parameters (process fluid, cooling medium, pressures, materials), maintenance history, licensing commitments, NEI Loss Control Standards, and operating experience.

Based on its review, the staff finds the applicant's response acceptable because this approach to establishing inspection locations for localized corrosion will add assurance of adequate management of the effects of aging.

During the audit and review process, the staff decided that more detail was needed to evaluate the adequacy of the inspection sample size and frequency. The staff asked the applicant for additional details of the methods that will establish the inspection sample size and frequency.

The applicant responded that a review of specific component mechanical design, environments, operating conditions, and flow paths combined with maintenance history and internal and industry operating experience will determine the inspection sample size and frequency. The sample size most likely will include peripheral tubes and areas within particular heat exchangers susceptible to wear, corrosion, or damage (*i.e.*, adjacent to inlet/outlet nozzles and changes in flow direction) and will be based on industry best practices and EPRI recommendations. The initial inspection results will determine the inspection frequency to detect effects of aging before loss of intended function. Visual inspections of accessible heat exchangers will be at the same frequency as eddy current inspections.

Based on its review, the staff finds the applicant's response acceptable because this approach to establishing inspection sample size and frequency will add assurance of adequate management of the effects of aging.

The staff also noted that the Heat Exchanger Monitoring Program does not describe when, where, and how program data are collected; therefore, the staff requested detail on data collection.

The applicant responded that this program is new and the data collection details are not available; however, inspections will be either online or during RFOs (depending on the particular component). The data will be collected and analyzed, and required actions will be taken at that time. The data also will be utilized for longer term trending and for developing future action plans and will be maintained in accordance with site QA program requirements.

Based on its review, the staff finds the applicant's response acceptable because this approach to establishing data collection will add assurance of adequate management of the effects of aging.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

(5) Monitoring and Trending - LRA Section B.1.15 states that results will be evaluated against established acceptance criteria and an assessment will be made on the applicable degradation mechanism, degradation rate, and allowable degradation level. The applicant will use this information to develop inspection scope and to modify inspection frequency if appropriate. Wall thickness will be trended and projected to the next inspection. Corrective actions will be taken if projections indicate that the acceptance criteria may not be met at the next inspection.

During the audit and review process, the staff determined that monitoring and trending were not described in enough detail to assess the predictability of the extent of degradation. The applicant was asked for details of the methods for assessing remaining component life for loss of material with inspection results for timely mitigative action.

The applicant responded that, because this program is new, exact details were not yet available. Wall thickness will be trended and projected to the next inspection. Corrective actions will be taken if projections indicate that the acceptance criteria may not be met at the next inspection. Trend information along with operating experience will determine the remaining component life.

Based on its review, the staff finds the applicant's response acceptable because this approach for establishing remaining component life will add assurance of adequate management of the effects of aging.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

(6) Acceptance Criteria - LRA Section B.1.15 states that the minimum acceptable tube wall thickness for each heat exchanger to be eddy current-inspected will be established based on a component-specific engineering evaluation. Wall thickness will be acceptable if greater than the minimum for the component.

To meet the acceptance criterion for visual inspections, heat exchanger heads, covers, and tube sheets must show no evidence of degradation that could lead to loss of function. If degradation that could lead to loss of intended function is detected, a condition report will be written and the issue resolved in accordance with the site corrective action program.

However, the applicant provided no numerical values or processes to establish acceptance criteria. The staff asked for more details on how acceptance criteria will be established.

The applicant responded that the minimum acceptable tube wall thickness for each heat exchanger to be eddy current-inspected will be established by a component-specific engineering evaluation based on code requirements, EPRI guidelines, and internal calculations. Wall thickness will be acceptable if greater than the minimum for the component. The acceptance criterion for visual inspections of heat exchanger heads, covers, and tube sheets will be no evidence of degradation that could lead to loss of function. If degradation is detected that, if not corrected, would lead to loss of intended function a condition report will be written and the issue resolved in accordance with the site corrective action program.

Based on its review, the staff finds the applicant's response acceptable because this approach to establishing acceptance criteria will add assurance of adequate management of the effects of aging.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

(10) Operating Experience - LRA Section B.1.15 states that there is no operating experience for the new Heat Exchanger Monitoring Program. However, operating experience with heat exchanger degradation is available from adherence to GL 89-13; therefore, the staff asked the applicant for heat exchanger wall thinning and other degradation operating experience from adherence to GL 89-13.

The applicant responded that GL 89-13 requires inspection of one RBCCW heat exchanger each refuel outage. Service water side inspections have detected some minimal tube plugging and weld or belzona repair to washed-out areas on the pass partition plate or tube sheet. Past inspections also have detected degraded gasket seating surfaces and tube inlet sleeve erosion requiring repairs. The copper nickel tube degradation typically due to internal erosion caused by material wedged in the tube is random in location. There also has been external tube damage in the area impacted by the shell-side inlet flow due to vibration. This particular operating experience is included in the Service Water Integrity Program, Section B.1.28, as a heat exchanger within the scope of the program and it confirms the program effectiveness. In accordance with NEI 95-10 "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," Revision 6, the review of operating experience either confirms the effectiveness of an existing program or detects new site-specific aging effects. For new programs like the Heat Exchanger Monitoring Program, Section B.1.15, application of this operating experience is not required.

Based on its review, the staff finds the applicant's response acceptable.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm that 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 SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.16, the applicant provided the UFSAR supplement for the Heat Exchanger Monitoring Program. The staff reviewed this section and finds the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

The LRA states that this program will be implemented before the period of extended operation (Commitment No. 12).

Conclusion. On the basis of its technical review of the applicant's Heat Exchanger Monitoring 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).

3.0.3.3.2 Containment Inservice Inspection Program

Summary of Technical Information in the Application. LRA Section B.1.16.1, "Containment Inservice Inspection," describes the existing Containment Inservice Inspection Program as plant-specific.

The Containment Inservice Inspection Program encompasses requirements for the inspection of Class MC pressure-retaining components (primary containment) and their attachments in accordance with 10 CFR 50.55a(b)(2) and the 1998 Edition of ASME Code Section XI with 2000 Addenda, Inspection Program B.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B.1.16.1 on the applicant's demonstration of the Containment Inservice Inspection Program to ensure that aging effects will be adequately managed so that intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff reviewed the Containment Inservice Inspection Program against the AMP elements in the GALL Report, 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 applicant indicated that the "corrective actions," "confirmation process," and "administrative controls" program elements 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:

(1) Scope of Program - LRA Section B.1.16.1 states that this program, under ASME Code Section XI, Subsection IWE, manages loss of material for the primary containment and its attachments. The primary containment is a GE Mark I pressure suppression containment system consisting of a drywell (housing the RV and reactor coolant recirculation loops), a pressure suppression chamber (housing a water pool), and the connecting vent system between the drywell and the water pool, isolation valves, and containment cooling systems. The construction code for the containment structure is the ASME Code Section III, 1965 Edition, and the latest addenda as of June 9, 1969,

including Code Cases 1330-1 and 1177-5.

The staff confirmed that the "scope of the program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

(2) Preventive Actions - LRA Section B.1.16.1 states that this monitoring program includes no preventive actions.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable.

(3) Parameters Monitored or Inspected - LRA Section B.1.16.1 states that primary containment and its attachments are inspected for evidence of cracks, wear, and corrosion.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

(4) Detection of Aging Effects - LRA Section B.1.16.1 states that the Containment Inservice Inspection Program manages loss of material for the primary containment and its attachments.

The primary inspection method for the primary containment and its attachments is visual examination. Visual examinations are either direct or remote, with sufficient illumination and resolution suitable for the local environment, to assess general conditions that may affect either the integrity of the containment structure or leak-tightness of the pressure-retaining component. The program includes augmented ultrasonic exams to measure containment structure wall thickness.

For steel, the Containment Inservice Inspection Program manages loss of material and cracking for ASME Code Class MC pressure-retaining steel components and their attachments. This aging effect is managed by visual inspections required by ASME Code Section XI, Subsection IWE.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

(5) Monitoring and Trending - LRA Section B.1.16.1 states that results are compared, as appropriate, to baseline data and other previous test results. For indications accepted for continued use by analytical evaluation, the areas containing them are monitored during successive inspection periods.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

(6) Acceptance Criteria - LRA Section B.1.16.1 states that results are compared, as appropriate, to baseline data, other previous test results, and acceptance criteria of ASME Code Section XI, Subsection IWE, for evaluation of any evidence of degradation.

In a letter dated January 29, 2007, the applicant stated:

> PNPS inspects the liner drains for the water reservoirs on the refuel floor (e.g., spent fuel pool, dryer/separator pool, and reactor cavity) for leakage. Leakage into the liner drain could be a precursor for water leaks which could wet the drywell shell exterior surface. These drains are examined for leakage after filling the refueling cavity. ...The code requires owners to identify locations they believe are suspect or potential problem areas for augmented inspection. After a review of PNPS drywell construction methods, PNPS identified various locations for augmented examination. Construction procedures required the gap forming material (Ethafoam) to be removed after each concrete lift had hardened and narrow polyurethane foam sealing strips to be inserted and left in place at the top of each lift, to prevent foreign material from entering the air gap as work progressed. There is some potential that these sealing strips might trap and hold leakage from the bellows and fuel pool, resulting in corrosion of the drywell shell outer surface. For this reason, augmented UT examinations in the upper drywell at elevation 72 feet (two locations) and elevation 83 feet (four locations) were performed in vertical strips to ensure the region of interest was examined. Three (3) of the examinations were performed in 1999 and three (3) in 2001. These examinations revealed no degradation of the drywell shell thickness in the upper drywell. ... UT thickness examinations will continue to be performed under PNPS IWE Program at two locations in the upper drywell immediately adjacent to the fuel pool due to the potential for leakage from the fuel pool liner. ... The drywell shell to floor joint is inspected under the PNPS IWE Program.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

(10) Operating Experience - LRA Section B.1.16.1 states that in 1999 the submerged regions of all 16 torus bays as well as the drywell to torus vent areas with water accumulation were inspected. Results revealed areas of defects: depleted zinc, localized pitting corrosion, and minor surface rusting. Degraded areas were re-coated to prevent further corrosion and then re-examined. Revelation of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects. An IWE visual exam in 1999 detected loose torus anchor bolt extensions and baseplate corrosion exceeding acceptance criteria. An inspection of torus saddle tie-down concrete anchor bolt assemblies was then performed and it was determined that, based on chemical testing of the ground water the ground water intrusion through the torus floor had not significantly degraded the tensile strength of the rock anchor bolts. During the Audit and Review, the staff asked the applicant if there has there been any ground water identified on the torus floor since 1999. In it response the applicant said that it had not identified any ground water found in the torus floor since 1999. Bolt

extensions were tightened, and corrosion was accepted by evaluation. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects.

The LRA states that in the RFO 14 (April 2003) ultrasonic thickness examination of the torus shell, several measurements were below the nominal wall thickness of 0.629 inches. As the measurements were all greater than the minimum allowable thickness of 0.563 inches, there was no further action taken. Containment ISI examinations will continue to monitor thickness of the torus shell. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects. Results of the containment ISI general visual walkdown of the primary containment during RFO 14 (April 2003) were compared to those of the previous inspection. The only new indication was in the CRD penetration area, where there was some surface corrosion but not significant and structurally acceptable. No significant corrosion was found in other areas. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects.

The LRA states that containment inservice inspections during RFO 15 (April 2005) revealed no evidence of loss of material. Absence of degradation provides evidence that the program effectively manages aging effects. Oyster Creek Generating Station experienced drywell corrosion due to salt water intrusion associated with refueling activities. Augmented IWE UT inspections prevented the same problem at PNPS. A QA audit and an NRC inspection in spring 2005 revealed no issues or findings with impact on program effectiveness.

The staff did not agree with the applicant that the absence of degradation provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of degradation.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm that 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 SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

However, recent inspection team observations indicated that:

- The flow switch in the bellows rupture drain had failed its surveillance in December 2005 and has not been fixed or evaluated. In addition, the flow switch also failed in 1999.
- Monitoring of other drains has been inconclusive and not well documented.
- The torus room floor has had water on the floor on multiple occasions.

In RAI B.1.16.1 dated November 7, 2006, the applicant was asked to address the above findings and discuss the impact on the aging management of potential loss of material due to corrosion in the inaccessible area of the Mark I steel containment drywell shell, basemat, including the sand pocket region for the period of extended operation. This was identified as OI 3.0.3.3.2 in the SER with OI issued in March 2007.

> In its response dated March 13, 2007, the applicant stated that on December 28, 2005 the flow switch in the bellows rupture drain (FS-4803) failed to respond acceptably during testing. The water normally flows into the flow switch, actuates the switch, and discharges to the radwaste system. The failure was caused by blockage of the passages around the perimeter of the baffle of the flow switch. On November 17, 2006, the flow switch was replaced with a new switch and the drain functionally tested. The flow switch indicates rupture of the refueling bellows seal when the refueling cavity is full of water during refueling operations. The last time the cavity was filled was during the refueling outage ending in May 2005. PNPS operates on a two-year refueling cycle, hence the next time the refueling cavity will be filled is in the spring of 2007. During the period from discovery of the FS-4803 failure to respond until replacement with the new switch in November 2006, there was no potential for undetected leakage since no water was present above the refueling bellows seal. A preventive maintenance task was established to replace flow switch FS-4803 every 15 years. Functional checks of the flow switch in the bellows rupture drain (FS-4803) are performed prior to each refueling outage and the switch is repaired, if necessary. Temporary failure of FS-4803 had no impact on the aging management of the inaccessible areas of the Mark I steel containment drywell shell.

In a letter dated May 1, 2007, the applicant included a torus room concrete basemat evaluation report from an Entergy consultant. With regard to the issue of water on the torus room floor, the report stated:

1. The groundwater migration through the 8ft. thick Reactor Building base mat is a highly localized phenomenon. It is caused by a 25ft hydraulic head difference, pushing groundwater through vertical joints and zones most likely weakened by tensions generated during setting and hydration following the construction. These localized zones are discontinuities equivalent to a vertical cylindrical hole of a maximum diameter of 4 mm (1/6 in). Such small discontinuities that originate from construction joints are inevitable in large-scale concrete engineering operations.

2. This highly localized nature of the zones through which water penetrates, does not compromise the overall structural performance of the Torus base mat: it does neither affect the bulk integrity of the concrete slab, nor the overall compressive and bending load bearing capacity of the reactor foundation.

3. Calcium leaching of the solid concrete is expected to take place in the localized zones through which water penetrates. While this localized calcium leaching does not affect the overall structural performance of the slab, it may contribute to further weakening the construction joints, and may eventually have degraded the grout in the annular space between the 3 in diameter hole and the 2 in diameter Williams rock anchors. A close-up inspection of the grout and bolt is recommended.

4. The lower pH-value of 9.3-9.4 of the water emerging from localized zones along the construction joints, compared to the typical pH-12 of concrete's bulk pore solution, is consistent with the calcium leaching observation. Its localized occurrence does not compromise the corrosion protection of the steel reinforcement in the slab. A refined corrosion indicator analysis is recommended to confirm the prevention or minimization of reinforcement and anchor bolt corrosion.

5. Changes in environmental conditions (e.g., seasonal changes in water table or a seismic event) that affect the static head that drives the water migration through the concrete would impact the rate of water seepage into the torus room. These affects [*sic*] would be small since, as discussed in the report, the discontinuities in the concrete base mat that are allowing the water seepage into the torus room are very small. Even if the current very low rate of water intrusion increased by an order of magnitude because of a change in static head there would be no impact on plant safety due to the large size of the torus room.

In a letter dated May 1, 2007, the applicant indicated that commitments 43, 45 and 46 will be implemented to address this issue. Commitment 43 includes provisions for testing groundwater aggressiveness within the Structures Monitoring Program. Commitment 46 states:

> Inspect the condition of a sample of the torus hold-down bolts and associated grout and determine appropriate actions based on the findings prior to the period of extended operation.

In a letter dated May 17, 2007 Commitment 45 was revised to state:

> If groundwater continues to collect on the Torus Room floor, obtain samples and test such water to determine its pH and verify the water is non-aggressive as defined in GALL Report Section III.A1 item III.A.1-4 once prior to the period of extended operation and once every five years during the period of extended operation.

The staff reviewed the response, the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm that plant-specific operating experience revealed no degradation not bounded by industry experience.

The applicant: stated that it had established a new preventive maintenance task to replace the flow switch and will continue functional checks each refueling outage; described the monitoring and documentation of the bellows rupture drain and other drains; identified the source of water on the torus floor as groundwater that has no relation to the failed flow switch and drain monitoring inspection findings and has no impact on drywell shell corrosion in general; showed that water intrusion into the torus room will not detrimentally affect the structure; and, identified monitoring programs that both inspect torus bolts and test water for aggressiveness. The staff finds the applicant's actions acceptable and concludes that concerns identified in OI 3.0.3.3.2 have been resolved. OI 3.0.3.3.2 is closed.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.17, the applicant provided the UFSAR supplement for the Containment Inservice Inspection Program. The staff reviewed this section and finds 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 technical review of the applicant's Containment 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 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 Inservice Inspection Program

Summary of Technical Information in the Application. LRA Section B.1.16.2, "Inservice Inspection," describes the existing Inservice Inspection Program as plant-specific.

The Inservice Inspection Program encompasses ASME Code Section XI, Subsections IWA, IWB, IWC, IWD, and IWF requirements. The program is based on ASME Code Inspection Program B (IWA-2432), which has 10-year inspection intervals. Every 10 years the program is updated to the latest ASME Code Section XI edition and addendum approved in 10 CFR 50.55a. On July 1, 2005, the applicant entered the fourth ISI interval. The ASME Code edition and addenda for the fourth interval are the 1998 Edition with 2000 Addenda. The current program ensures that the structural integrity of Classes 1, 2, and 3 systems and supports is maintained at the level required by 10 CFR 50.55a.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B.1.162 on the applicant's demonstration of the Inservice Inspection Program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff reviewed the Inservice Inspection Program against the AMP elements found in the GALL Report, 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 applicant indicated that the "corrective actions," "confirmation process," and "administrative controls" program elements 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:

(1) Scope of Program - LRA Section B.1.16.2 states that this program manages cracking, loss of material, and reduction of fracture toughness of reactor coolant system piping, components, and supports. The program implements applicable requirements of ASME Code Section XI, Subsections IWA, IWB, IWC, IWD, and IWF, and other requirements specified in 10 CFR 50.55a with NRC-approved alternatives and relief requests. Every 10 years, the Inservice Inspection Program is updated to the latest ASME Code Section XI edition and addendum approved in 10 CFR 50.55a.

The applicant stated that ASME Code Section XI inspection requirements for RV internals (Subsection IWB, Categories B-N-1 and B-N-2) are not in the Inservice Inspection Program but included in the BWR Vessel Internals Program. For more information on the BWR Vessel Internals Program see SER Section 3.0.3.2.7.

During the audit and review, the staff noted that the applicant's "scope of program" description includes a reference to "relief requests." Because ASME Code Section XI relief requests are not approved in the license renewal process the staff asked the applicant to clarify its reference to relief requests in the "scope of program" description.

In a conference call on September 25, 2006, the applicant agreed to revise the first paragraph of the "scope of program" description for the Inservice Inspection Program as follows:

> The ISI Program manages cracking, loss of material, and reduction of fracture toughness of reactor coolant system piping, components, and supports. The program implements applicable requirements of ASME Section XI, Subsections IWA, IWB, IWC, IWD and IWF and other requirements specified in 10 CFR 50.55a with approved NRC alternatives. Every 10 years the ISI Program is updated to the latest ASME Section XI code edition and addendum approved by the NRC in 10 CFR 50.55a.

The staff noted that the applicant's response deleted the reference to relief requests from the "scope of program" description. In a letter dated October 6, 2006, the applicant included in Attachment F portions of LRA Sections B.1.16 and B.1.16.2 showing the deletion of all references to relief requests from the LRA.

The staff confirmed that the "scope of the program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

(2) Preventive Actions - LRA Section B.1.16.2 states that this condition monitoring program includes no preventive actions.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable.

(3) Parameters Monitored or Inspected - LRA Section B.1.16.2 states that the program uses NDE techniques to detect and characterize flaws. The applicant stated that volumetric examinations (*e.g.*, radiographic, ultrasonic, or eddy current) locate surface and subsurface flaws. Surface examinations, (*e.g.*, magnetic particle or dye PT) locate surface flaws.

The applicant stated that three levels of visual examinations are specified. VT-1 visual examination assesses the condition of the surface of the part examined, looking for cracks and symptoms of wear, corrosion, erosion, or physical damage. It can be done with either direct visual or remote examination by various optical and video devices. The applicant stated that VT-2 visual examination is specifically for locating evidence of leakage from pressure-retaining components (period pressure tests). While the system is under pressure for a leakage test, visual examinations detect direct or indirect indication of leakage. The applicant stated that VT-3 visual examination determines the general mechanical and structural condition of components and supports and detects discontinuities and imperfections.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

(4) Detection of Aging Effects - LRA Section B.1.16.2 states that the Inservice Inspection Program manages cracking and loss of material for carbon steel, low-alloy steel, and stainless steel/nickel-based alloy RPV subcomponents using NDE techniques specified in ASME Code Section XI, Subsections IWB, IWC, and IWD examination categories.

The applicant stated that the Inservice Inspection Program manages cracking, loss of material, and reduction of fracture toughness of RCS components using NDE techniques specified in ASME Code Section XI, Subsections IWB, IWC, and IWD examination categories.

The applicant stated that the Inservice Inspection Program manages loss of material for ASME Class MC and Class 1, 2, and 3 piping and component supports and their anchorages by visual examination of components using NDE techniques specified in ASME Code Section XI, Subsection IWF examination categories.

The applicant also stated that there are no AERMs for Lubrite® sliding supports; however, the Inservice Inspection Program will confirm the absence of aging effects for the period of extended operation.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable because it follows the requirements of ASME Code Section XI, Subsections IWB, IWC, and IWD.

(5) Monitoring and Trending - LRA Section B.1.16.2 states that results are compared as appropriate to baseline data and other previous test results and that, if indications are accepted for continued use by analytical evaluation, the areas containing them are monitored during successive inspection periods.

The applicant stated that ISI results are recorded every operating cycle and submitted to the NRC after each RFO in owner activity reports prepared by the Inservice Inspection Program coordinator. The applicant also stated that these detailed reports include scope of inspection and significant inspection results.

The staff noted that the "monitoring and trending" program element for the plant-specific Inservice Inspection Program in the LRA described the monitoring and trending process only very broadly with no express reference to ASME Code Section XI requirements and that the description did not appear to reflect the level of detail described for this program element in SRP-LR Section A.1.2.3.5. The staff asked the applicant for a description of the parameter(s) or indicator(s) trended and of the methodology for analysis of inspection or test results.

In its response dated July 19, 2006, the applicant amended the "monitoring and trending" program element in LRA Section B.1.16.2 to include the following information:

> Results are compared, as appropriate, to baseline date and other previous test results. Indications are evaluated in accordance with ASME Section XI. If the component is qualified as acceptable for continued service, the area containing the indication is reexamined during subsequent inspection periods. Examinations that reveal indications that exceed the acceptance standards are extended to include additional examinations in accordance with ASME Section XI.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

(6) Acceptance Criteria - LRA Section B.1.16.2 states that a pre-service, or baseline, inspection of program components before startup assured freedom from defects greater than code-allowable. The applicant stated that these baseline data are also an evaluative basis for subsequent ISI results. The applicant stated that since plant startup additional inspection criteria for Classes 2 and 3 components have been imposed by 10 CFR 50.55a, for which baseline and inservice data also have been obtained and that results of ISIs are compared, as appropriate, to baseline data, other previous test results, and acceptance criteria of the ASME Code Section XI, 1998 Edition, 2000 Addenda, for evaluation of any evidence of degradation.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

(10) Operating Experience - LRA Section B.1.16.2 states that IGSCC was discovered during RFO 06 in the thermal sleeve at nine of the ten recirculation supply nozzles. A GE evaluation has demonstrated no further crack growth with HWC protection. A scheduled ISI surface examination in 1997 detected an indication adjacent to a welded pipe support lug. The lug was removed and the indication repaired by welding. A scheduled ISI visual examination in 1999 detected a snubber with restricted movement and cold piston setting out of tolerance. The restriction was reworked and the cold piston setting was evaluated and accepted. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects.

The LRA states that between RFO 13 and RFO 14 and during RFO 14 (April 2003) 142 scheduled ISI (ASME Code Section XI Subsections IWB, IWC, IWD, and IWF) examinations on-line showed that one spring hanger support in the residual heat removal system required rework because ISI visually detected loose bolting. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects.

The LRA states that between RFO 14 and RFO 15 and during RFO 15 (April 2005) 194 scheduled ISI (ASME Code Section XI Subsections IWB, IWC, IWD, and IWF) examinations on-line showed that cracked welds on four steam dryer tie-bars had been repaired, loose bolting on a hanger reworked, a UT exam indication on a SLC system weld repaired, and a number of RPV safe-end welds evaluated and accepted because of wall thickness less than the screening criteria but not less than design minima. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program effectively manages aging effects. A QA audit and a staff inspection in spring 2005 revealed no issues or findings with impact on program effectiveness.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm that 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 SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.18, the applicant provided the UFSAR supplement for the Inservice Inspection Program. 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. On the basis of its technical review of the applicant's Inservice Inspection Program, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.4 Instrument Air Quality Program

Summary of Technical Information in the Application. LRA Section B.1.17, "Instrument Air Quality," describes the existing Instrument Air Quality Program as plant-specific.

The Instrument Air Quality Program ensures that instrument air supplied to components is free of water and significant contaminants, preserving an environment not conducive to loss of material. Instrument air quality is checked periodically for dewpoint, particulate contamination, and hydrocarbon concentration.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B.1.17 on the applicant's demonstration of the Instrument Air Quality Program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff reviewed the Instrument Air Quality Program against the AMP elements found in the GALL Report, 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 applicant indicated that the "corrective actions," "confirmation process," and "administrative controls" program elements 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:

(1) Scope of Program - LRA Section B.1.17 states that this program applies to components within the scope of license renewal and subject to an AMR supplied with instrument air (IA) for which pressure boundary integrity is required for the components to perform intended functions. During the audit and review, the staff requested the specific components subject to the Instrument Air Quality Program.

The applicant responded that tubing and valve bodies are managed by the standby gas treatment system and piping, tanks, tubing, and valve bodies are managed by the IA system.

The applicant stated that the Instrument Air Quality Program will be enhanced to include sample points in the standby gas treatment system and torus vacuum breaker IA subsystem in addition to the IA header sample points. The applicant stated in the LRA that this enhancement will start before the period of extended operation. The implementation of this enhancement will verify that the environment of the standby gas treatment system and torus vacuum breaker IA subsystem will not be conducive to loss of material, thus adding assurance that loss of material will be adequately managed.

The staff confirmed that the "scope of the program" program element satisfies the criterion defined in the GALL Report and SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable as it will be augmented to ensure that loss of material will be adequately managed.

(2) Preventive Actions - LRA Section B.1.17 states that system air quality is monitored and maintained within specified limits to maintain IA supplied to components is free of water and significant contaminants, preventing loss of material.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2. The staff finds this program element provides acceptable assurance that the IA will be monitored and maintained.

(3) Parameters Monitored or Inspected - LRA Section B.1.17 states that dew point, particulate contamination, and hydrocarbon concentration (oil mist) are checked periodically to verify maintenance of IA quality.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

(4) Detection of Aging Effects - LRA Section B.1.17 states that dew point, particulate contamination, and hydrocarbon concentration are checked periodically to verify maintenance of IA quality, preventing loss of material. At least every 18 months, dewpoint, particulate contamination, and hydrocarbon concentration are monitored at several IA system locations.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

(5) Monitoring and Trending - LRA Section B.1.17 states that results of sample analyses are maintained in the chemistry log. A condition report is issued if data indicate deteriorating IA quality.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

(6) Acceptance Criteria - LRA Section B.1.17 states that the dew point is less than or equal to -20°F and oil mist and particulate are less than 1.2 mg/m^3.

The Instrument Air Quality Program acceptance criteria are dew point less than or equal to -20°F and oil mist and particulate less than 1.2 mg/m^3; therefore, this program features numerical values of acceptance criteria. The LRA did not provide the bases for the acceptance criteria, and, therefore, during the audit and review, the staff requested these bases.

The applicant responded that the bases of the acceptance criteria are American National Standards Institute/Instrumentation, Systems, and Automation Society 7.3, cited in the applicant's Procedure 7.1.69, "System Air Quality Sampling."

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

(10) Operating Experience - LRA Section B.1.17 states that in 1999 an IA dryer dewpoint reading was greater than the acceptance criterion of less than or equal to -20 °F. A faulty solenoid valve was replaced and dew point was confirmed as less than or equal to -20 °F. Monitoring of IA quality and subsequent corrective actions provide evidence that the program effectively manages loss of material and cracking of IA system components.

For a period of time (October 2001 through March 2005), dew point, particulate contamination, and hydrocarbon concentration (oil mist) were not sampled in the IA system. Procedures were corrected in March 2005 to require dew point, particulate contamination, and hydrocarbon concentration (oil mist) sampling at several IA system locations. Sample results for the service air system, which supplies the IA system, showed dew point, oil mist, and particulates within acceptance criteria. IA header moisture checks during the same period found little or no moisture; therefore, IA quality has been and will be maintained by Instrument Air Quality Program sampling. Continuous confirmation of IA quality and subsequent corrective actions provide evidence that the program effectively manages loss of material and cracking of instrument air system components.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm that 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 SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.19, the applicant provided the UFSAR supplement for the Instrument Air Quality Program. During the audit and review, the staff noted that the applicant's description of the program in the UFSAR supplement in LRA Appendix A did not include, as commitments, the enhancement described in LRA Section B.1.17. The staff asked the applicant to include a description of the enhancements to the Instrument Air Quality Program in the UFSAR supplement in LRA Appendix A.

In its response dated September 13, 2006, the applicant included this commitment (Commitment No. 13) to be implemented before the period of extended operation.

The staff then 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. On the basis of its technical review of the applicant's Instrument Air Quality 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).

3.0.3.3.5 Periodic Surveillance and Preventive Maintenance Program

Summary of Technical Information in the Application. LRA Section B.1.24, "Periodic Surveillance and Preventive Maintenance," describes the existing Periodic Surveillance and Preventive Maintenance Program as plant-specific.

The Periodic Surveillance and Preventive Maintenance Program includes periodic inspections and tests that manage aging effects not managed by other AMPs. Preventive maintenance and surveillance testing are implemented generally through repetitive tasks or routine monitoring of plant operations. Credit for program activities has been taken in the AMRs of the following systems and structures: reactor building; process facilities; SLC system; automatic depressurization system; high pressure coolant injection system; reactor core isolation cooling system; standby gas treatment system; RBCCW system; EDG system; SBO diesel generator system; heating, ventilation, and air conditioning systems; security diesel; condensate storage system; and nonsafety-related systems affecting safety-related systems.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B.1.24 on the applicant's demonstration of the Periodic Surveillance and Preventive Maintenance Program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff reviewed the Periodic Surveillance and Preventive Maintenance Program against the AMP elements found in the GALL Report, 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 applicant indicated that the "corrective actions," "confirmation process," and "administrative controls" program elements 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:

(1) Scope of Program - LRA Section B.1.24 states that this program for license renewal includes component and system specific tasks credited with managing effects of aging indicated in AMRs.

The staff confirmed that the "scope of the program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

(2) Preventive Actions - LRA Section B.1.24 states that inspection and testing activities used to detect component aging effects do not prevent aging effects. However, such activities are intended to prevent component failures that might be caused by effects of aging.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable.

(3) Parameters Monitored or Inspected - LRA Section B.1.24 states that this program provides instructions for monitoring SSCs to detect degradation. Inspection and testing monitor various parameters, including system flow, system pressure, surface condition, loss of material, presence of corrosion products, and signs of cracking.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

(4) Detection of Aging Effects - LRA Section B.1.24 states that PM activities and periodic surveillance provide for periodic component inspections and testing to detect effects of aging. Inspection intervals are established such that they provide timely detection of degradation. Inspection intervals are dependent on component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations. Each inspection or test occurs at least once every 10 years.

The extent and schedule of inspections and testing assure detection of component degradation before loss of intended functions. Established techniques such as visual inspections are used.

The staff noted in the program evaluation report that enhancements to existing procedures or development of new procedures will be necessary to implement the inspections of this program. Therefore, the applicant committed to an enhancement (Commitment No. 21) to the Periodic Surveillance and Preventive Maintenance Program in the LRA that will assure that the effects of aging will be managed, for applicable components, such that they will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Before the period of extended operation, program activity implementing documents will be enhanced as necessary to assure that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the CLB for the period of extended operation.

The PNPS Periodic Surveillance and Preventive Maintenance Program describes when, where, and how program data are collected and provides justification that technique and frequency are adequate to detect effects of aging before loss of SC intended function. However, the staff noted that there were no codes or standards cited in the program. As a result, the staff asked the applicant to provide any codes and standards used for detection of aging effects.

The applicant responded that many of the maintenance activities include visual or other NDEs of SSCs. These examinations are performed in accordance with approved procedures that are consistent with ASME Code Section XI and 10 CFR Part 50, Appendix B.

The staff determines that the applicant's response is acceptable because appropriate codes are identified in accordance with the SRP-LR.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

(5) Monitoring and Trending - LRA Section B.1.24 states that preventive maintenance and surveillance testing monitor and trend aging degradation. Inspection and testing intervals are established for timely detection of component degradation. Inspection and testing intervals depend on component material and environment and consider industry and plant-specific operating experience and manufacturer recommendations.

Although the Periodic Surveillance and Preventive Maintenance Program states the monitoring and trending attributes, the staff determined that the LRA was not detailed enough for an assessment of this program element. As a result, the staff requested trending methods for this program.

The applicant responded that inspection and testing intervals are established for timely detection of SSC degradation. Inspection and testing intervals depend on the material and environment and consider industry and plant-specific operating experience and manufacturer' recommendations. Trending of degraded components is within the corrective action program.

The staff determines that the applicant's response is acceptable because this approach of establishing degradation trends adequately detects effects of aging in SSCs before loss of intended functions.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

(6) Acceptance Criteria - LRA Section B.1.24 states that the Periodic Surveillance and Preventive Maintenance Program acceptance criteria are defined in specific inspection and testing procedures that confirm component integrity by verifying the absence of aging effects or by comparing parameters to limits based on intended functions established by plant design basis.

The staff determines that the Periodic Surveillance and Preventive Maintenance Program acceptance criteria are defined in specific inspection and testing procedures.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

(10) Operating Experience - LRA Section B.1.24 states that inspection of the reactor building crane in 2000 and of the refueling platform in March 2003 found no significant corrosion or wear.

The LRA states that visual inspection of the main stack and guy wires in June 2004 *revealed no significant corrosion of steel structures and components. Similarly, inspection* of the concrete anchor blocks revealed no cracking, spalling, or other loss of material.

LRA Section B.1.16.1 states that in 1999, the below-water regions of all 16 torus bays as well as the drywell-to-torus vent areas with water accumulation were inspected. Results revealed areas of defects such as depleted zinc, localized pitting corrosion, and minor surface rusting. Degraded areas were re-coated to prevent further corrosion and then re-examined. The discovery of degradation and the implementation of corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

LRA Section B.1.16.1 states that an IWE visual exam in 1999 detected loosed torus anchor bolt extensions and baseplate corrosion exceeding acceptance criteria. Bolt extensions were tightened. Corrosion was accepted by evaluation. Detection of degradation and corrective action prior to loss of intended function provide evidence that the program is effective for managing aging effects.

The LRA states that in 1999, visual inspection of the drywell spray header revealed no significant corrosion. Additionally, the submerged regions of all 16 torus bays as well as the drywell to torus vent areas with water accumulation were inspected. The condition of other submerged structures and components also was reported. Results revealed no significant corrosion on submerged structures and components within the torus.

The LRA states that during visual inspection of standby gas treatment system exhaust fans in 2000 and 2001, the expansion joints which connect the fans to ductwork were disconnected from the fans to facilitate fan inspection. Inspection of the expansion joints revealed no cracking. No significant corrosion or wear was found on the RRS motor generator set area cooling coils during a 2000 inspection.

The LRA states that during a 2002 run of the A EDG, soot buildup was noted on the turbo charger. Although no obvious leakage was noted, soot buildup may indicate a small exhaust leak. Thermography during the next diesel run to determine whether and where leakage had occurred found no leakage.

The LRA states that inspections of EDG air intake and jacket water radiator components in 1999 and 2004 revealed no significant corrosion, wear, or fouling nor was significant corrosion found on air start or exhaust components.

The LRA states that EDG surveillance tests in April 2005 for both generators showed that air manifold temperature did not fluctuate significantly during the loaded run, providing evidence that the program effectively manages fouling of EDG intake air cooler tubes.

The LRA states that inspections of SBO diesel jacket water radiator components in 2001 revealed no significant corrosion, wear, or fouling nor was significant corrosion found on air start or exhaust components. Minor corrosion on the inside surface of the air intake silencer housing was found not to affect the ability of the silencer to perform its intended function.

The LRA states that SBO diesel generator surveillance tests in May 2005 showed that air manifold temperature did not fluctuate significantly during the loaded run, providing evidence that the program effectively manages fouling of SBO diesel intake air cooler tubes.

The LRA states that visual inspection of the control room emergency air supply system blowers in 1999 revealed no cracking of the flexible connectors on these components.

The LRA states that a thorough inspection of the security diesel intake air components, exhaust components, and the jacket water radiator in 1998 revealed no significant corrosion, cracking, wear, or fouling.

The LRA states that security diesel generator surveillance tests in 2002, 2003, and 2004 showed that air manifold temperature did not fluctuate significantly during the loaded run, providing evidence that the program effectively manages fouling of security diesel intake air cooler tubes.

The LRA states that an inspection of the 'A' condensate storage tank in April 2003 noted paint flaking off the interior of the tank, corrosion nodules on the sidewall and floor, and a 2- to 3-inch diameter by ½-inch deep depression in the tank floor. The 'B' condensate storage tank also was inspected with no corrosion or coating degradation observed. A long-term corrective action was initiated to assess the interior condition of the 'A' condensate storage tank, review the coating system, select an appropriate recoating system, and repair and recoat the tank.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm that 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 SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

UFSAR Supplement. In LRA Section A.2.1.26, the applicant provided the UFSAR supplement for the Periodic Surveillance and Preventive Maintenance Program. During the audit and review, the staff noted that the applicant's description of the program in the UFSAR supplement in LRA Appendix A, did not include, as a commitment, the enhancement described in LRA Section B.1.24. The staff asked the applicant to include a description of the program enhancement in the UFSAR supplement in LRA Appendix A per SRP-LR Section 3.1.2.4.

In its response dated July 19, 2006, the applicant stated that Commitment No. 21 specifies an enhancement to this program.

The staff then 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. On the basis of its technical review of the applicant's Periodic Surveillance and Preventive Maintenance 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).

3.0.3.3.6 Water Chemistry Control - Auxiliary Systems Program

Summary of Technical Information in the Application. LRA Section B.1.32.1, "Water Chemistry Control - Auxiliary Systems," describes the existing Water Chemistry Control - Auxiliary Systems Program as plant-specific.

The purpose of the Water Chemistry Control - Auxiliary Systems Program is to manage loss of material for components exposed to treated water. Program activities include sampling and analysis of the stator cooling water system to minimize component exposure to aggressive environments.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information in LRA Section B.1.32.1 on the applicant's demonstration of the Water Chemistry Control - Auxiliary Systems Program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff reviewed the Water Chemistry Control - Auxiliary Systems Program against the AMP elements found in the GALL Report, 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 applicant indicated that the "corrective actions," "confirmation process," and "administrative controls" program elements 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:

(1) Scope of Program - LRA Section B.1.32.1 states that the program samples and analyzes the stator cooling water system to minimize component exposure to aggressive environments.

City water is taken from the Town of Plymouth water main and distributed throughout the potable and sanitary water system at town water pressure. City water is monitored and treated by the Town of Plymouth to meet the regulations of the Commonwealth of Massachusetts.

The staff confirmed that the "scope of the program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

(2) Preventive Actions - LRA Section B.1.32.1 states that the program includes monitoring and control of stator cooling water to minimize exposure to aggressive environments.

City water in the potable and sanitary water system is monitored and treated by the Town of Plymouth to meet the regulations of the Commonwealth of Massachusetts.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable.

(3) Parameters Monitored or Inspected - LRA Section B.1.32.1 states that, in accordance with industry recommendations, stator cooling water parameters monitored are conductivity, corrosion products, and dissolved oxygen.

City water in the potable and sanitary water system is monitored and treated by the Town of Plymouth to meet the regulations of the Commonwealth of Massachusetts

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

(4) Detection of Aging Effects - LRA Section B.1.32.1 states that the program manages loss of material for stator cooling water system and potable and sanitary water system components.

The One-Time Inspection Program describes inspections planned to verify the effectiveness of water chemistry control programs to ensure that significant degradation does not occur and component intended functions are maintained during the period of extended operation.

The staff noted that frequency of sampling water chemistry was not specified. The staff asked the applicant for the frequencies.

The applicant responded that stator cooling water conductivity is monitored continuously by three conductivity elements with remote readouts and alarms. Dissolved oxygen is measured by a portable oxygen meter with a continuous local display read weekly and the value recorded. If the oxygen meter is out of service, a weekly grab sample is obtained for a chemical analysis. Monthly copper analyses monitor for corrosion.

1. Three installed plant conductivity elements (Piping and Instrumentation Diagram M275) are read out remotely and alarmed for operations. In addition, one portable conductivity meter is kept in sample panel C-3006 with only a local readout. Normally, the portable meter satisfies the Procedure No. 7.8.1 grab sample requirement; however, the applicant is considering removing the portable meter from the sample panel and using just the installed conductivity elements. With three conductivity elements, there is more than enough monitoring.

2. The only oxygen meter is portable and located in sample panel C-3006. The meter has a continuous local readout display but no remote readout or alarms. It is read weekly and the value recorded. If the oxygen meter is out of service, a weekly grab sample is obtained for a chemical analysis.

3. PNPS does no corrosion products analyses, only copper analyses.

Since the applicant has specified the frequencies, the staff finds the applicant's response acceptable.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

(5) Monitoring and Trending - LRA Section B.1.32.1 states that values from analyses are archived for long-term trending and review.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5. The staff finds this program element acceptable.

(6) Acceptance Criteria - LRA Section B.1.32.1 states that, in accordance with industry recommendations, acceptance criteria for the stator cooling water system are as follow:

- conductivity less than 0.3 S/cm
- dissolved oxygen greater than 2.0 ppm/less than 8.0 ppm
- corrosion products no detectable activity

However, the staff noted that the units for conductivity were incorrect and, as stated in Section 3.0.3.3.6, the applicant does no corrosion products analyses. Instead, copper analyses are done. The staff asked the applicant to clarify the conductivity units and the statement on corrosion products.

In its response dated July 19, 2006, the applicant explained that the stated criteria were a software conversion error. LRA Section B.1.32.1, Element 6, was amended to correct the units of conductivity to μS/cm and delete the acceptance criterion for corrosion products. Corrosion product (copper) sampling determines the type of copper oxide layer formed. Thus, it is a diagnostic parameter without an acceptance criterion.

The staff reviewed Procedure No. 7.8.1, Revision 40, "Chemistry Sample and Analysis Program Procedure," and determines that the response is acceptable.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

(10) Operating Experience - LRA Section B.1.32.1 states that in the spring of 2001 a small leak of hydrogen into the stator coolant causing displacement of oxygen was detected and repaired. Continuous confirmation of stator cooling water quality and timely corrective actions provide evidence that the program effectively manages loss of material for stator cooling water system components. Stator cooling water sample results between October 2001 and January 2002 revealed oxygen concentrations below the 2 ppm acceptance criterion. Feed and bleed operations introduced atmospheric oxygen into the cooling water to correct the oxygen level. Oxygen levels did not go below 0.76 ppm and copper concentrations remained normal with no adverse trend. Continuous confirmation of stator cooling water quality and timely corrective actions provide evidence that the program effectively manages loss of material for stator cooling water system components.

Stator cooling water sample results from January 1, 2004, through September 7, 2005, revealed only two instances of a parameter outside acceptance criteria. On July 1, 2004, measured dissolved oxygen was 1.84 ppm. The acceptance criterion for dissolved oxygen is between 2.0 and 8.0 ppm. Subsequent readings were within the acceptance criterion range and corrective action was not required. On April 7, 2005, measured dissolved oxygen was 0.90 ppm. In this instance the applicant determined that the oxygen probe had failed. A grab sample analysis result was a dissolved oxygen reading within acceptance criteria. Continuous confirmation of stator cooling water quality provides evidence that the program effectively manages loss of material for stator cooling water system components. QA audits in 2000, 2002, and 2004 revealed no issues or findings with impact on program effectiveness.

The staff reviewed the operating experience presented in the LRA and interviewed the applicant's technical personnel to confirm that 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 SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

<u>UFSAR Supplement</u>. In LRA Section A.2.1.36, the applicant provided the UFSAR supplement for the Water Chemistry Control - Auxiliary Systems Program. In its letter dated July 19, 2006, the applicant stated that the effectiveness of the Water Chemistry Control – Auxiliary Systems, BWR, and Closed Cooling Water Programs is confirmed by the One-Time Inspection Program. For further clarification, LRA Appendix A is revised for these three water chemistry control programs to include the sentence, "The One-Time Inspection Program will confirm the effectiveness of the program."

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>. On the basis of its technical review of the applicant's Water Chemistry Control - Auxiliary Systems 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).

3.0.3.3.7 Bolted Cable Connection Program

<u>Summary of Technical Information in the Application</u>. In a letter dated January 10, 2007, the applicant submitted Appendix B and stated that the plant-specific Bolted Cable Connections Program has been developed as an alternative to GALL AMP XI.E6. This program will be implemented prior to the period of extended operation.

Staff Evaluation. The staff reviewed the Bolted Cable Connections Program against the AMP elements 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 applicant indicated that the "corrective actions," "confirmation process," and "administrative controls" program elements 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:

(1) Scope of Program - The "scope of program" program element criterion in SRP-LR Section A.1.2.3.1 requires the program scope to include the specific structures and components addressed.

The applicant states for the "scope of program" program element that this program includes non-EQ connections for cables within the scope of license renewal and not the high-voltage (>35 kV) switchyard connections. In-scope connections are evaluated for applicability of this program. The criteria for inclusion in the program are that the connection is bolted and not covered under the EQ program or a preventive maintenance program.

The staff determined that the specific commodity groups for which the program manages effects of aging are defined (non-EQ bolted cable connections for cables within the scope of license renewal), satisfying the SRP-LR Section A.1.2.3.1 criterion. The staff also found the exclusion of high-voltage (>35 kV) switchyard connections and those under the EQ program and an existing preventive maintenance program acceptable. Switchyard connections are addressed in SER Section 3.6.2.2. EQ cable connections are covered in accordance with 10 CFR 50.49. Cable connections under preventive maintenance programs are inspected periodically. On these bases, the staff finds the applicant's "scope of program" element acceptable.

(2) Preventive Actions - The SRP-LR Section A.1.2.3.2 "preventive actions" program element criterion is that condition monitoring programs do not rely on preventive actions, which need not be provided.

The applicant states in AMP B.1.34, for the "preventive actions" program element, that this One-Time Inspection program is a condition monitoring program; therefore, no actions are taken under 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 the applicant's response acceptable because this condition monitoring program has no need for preventive actions. On this basis, the staff finds the applicant's "preventive actions" element acceptable.

(3) Parameter Monitored or Inspected - The "parameters monitored or inspected" program element criteria in SRP-LR Section A.1.2.3.3 are:

The parameters to be monitored or inspected should be linked to the degradation of the particular structure and component intended function(s) to detect the presence and extent of effects of aging.

The applicant states in AMP B.1.34, for the "parameters monitored or inspected" element that this program will focus on the metallic parts of cable connections. The one-time inspection verifies that the loosening of bolted connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation is not a problem that requires a periodic AMP.

The staff determined that the "parameters monitored or 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 effects of aging due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. The design of bolted cable connections usually accounts for such stressors. The one-time inspection confirms that these stressors require no periodic AMP. On this basis, the staff finds the applicant's "parameters monitored or inspected" program element acceptable.

(4) Detection of Aging Effects - The "detection of aging effects" program element criteria in SRP-LR Section A.1.2.3.4 are:

- Provide information that links the parameters monitored or inspected to the effects of aging managed
- Describe when, where, and how program data are collected (*i.e.*, all program aspects of data collection)
- Devise a method for the inspection sample size when inspecting a group of SCs by samples. The SCs inspected should be based on similarity of materials of construction, fabrication, procurement, design, installation, operating environment, effects of aging.

The applicant states in AMP B.1.34, for 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 for effects of aging requiring management. 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 will be documented. Inspection may be by thermography, contact resistance testing, visual based on plant configuration and industry guidance, or other appropriate methods. The one-time inspection adds confirmation to support original equipment that shows electrical connections have not experienced a high rate of failures and that existing installation and maintenance practices are effective.

The staff determined that this program element satisfies the criteria defined in SRP-LR Section A.1.2.3.4. Thermography detects effects of aging of bolted cable connections due to thermal cycling, ohmic heating, electrical transients, and vibration. Contact resistance measurement is an appropriate inspection technique for detecting high resistance of bolted cable connections due to chemical contamination, corrosion, and oxidation. Visual inspection is an alternative technique to thermography for measuring connection resistance of bolted connections covered with heat shrink tape, sleeving, insulating boots, etc. The staff also determined that the proposed one-time inspection is acceptable because the design of these connections will account for effects of aging by stressors and confirm that they should not be significant aging problems. On this basis, the staff finds the applicant's "detection of aging effects" program element acceptable.

(5) Monitoring and Trending - The "monitoring and trending" program element criteria in SRP-LR Section A.1.2.3.5 are:

Monitoring and trending activities should be described and they should predict the extent of degradation for effective corrective or mitigative actions.

This program element describes how the data collected are evaluated and also may include trending for a forward look. The parameter or indicator trended should be described.

The applicant states in AMP B.1.34, for the "monitoring and trending" program element, that in this program trending actions are not included because the inspection is a one-time inspection.

The staff determines that absence of trending for testing is acceptable because the test is a one-time inspection and the ability to trend inspection results is limited by the available data. Furthermore, the staff saw no need for such activities. On this basis, the staff finds the applicant's "monitoring and trending" program element acceptable.

(6) Acceptance Criteria - The "acceptance criteria" program element criteria in SRP-LR Section A.1.2.3.6 are:

The acceptance criteria of the program and their bases should be described. The acceptance criteria, against which the need for corrective actions is evaluated, should maintain SC intended function(s) under all CLB design conditions during the period of extended operation.

The program should include a methodology for analyzing results against acceptance criteria.

Qualitative inspections should have the same predetermined criteria as quantitative inspections in accordance with the ASME Code and through approved site-specific programs.

The applicant states in AMP B.1.34, for the "acceptance criteria" program element, that the acceptance criteria for each inspection/surveillance are defined by the type of inspection or test for the specific cable connections. Acceptance criteria ensure that cable connection intended functions can be maintained consistent with the CLB.

The staff determines that this program element satisfies SRP-LR Section A.1.2.3.6 criteria. The staff finds it acceptable because inspection/surveillance acceptance criteria are defined by the type of inspection or test for the specific type of connection. The applicant will follow current industry standards to maintain the license renewal intended functions of the cable connections consistent with the CLB.

(10) Operating Experience - The SRP-LR Section A.1.2.3.10 "operating experience" program element criterion states that operating experience should be objective evidence that the effects of aging will be adequately managed to maintain structure and component intended function(s) during the period of extended operation.

The applicant states, in the supplemental LRA, for this program element, that operating experience shows that loosening of connections and corrosion of connections could be a problem without proper installation and maintenance activities. Industry original equipment supports this One-Time Inspection program in lieu of periodic testing to confirm effective installation and maintenance. The Bolted Cable Connections Program is new. Plant-specific and industry operating experience were considered in the program development. Industry operating experience as the basis for the program is in the "operating experience" element of the GALL Report Section XI.E6 program description and plant-specific operating experience is consistent with it.

To respond to NEI concerns about lack of operating experience to support GALL AMP XI.E6 (NEI White Paper on GALL Aging Management Program XI.E6, dated September 5, 2006), the staff found that very few operating experiences with failed connections due to aging have been reported and that these cannot support periodic inspection as recommended in GALL AMP XI.E6. The staff agreed with the applicant's assessment of operating experience. The staff finds that the proposed One-Time Inspection Program will ensure that either aging of metallic cable connections does not occur or existing preventive maintenance is effective and that a periodic inspection program is not required.

Based on its review, the staff concludes that the applicant's Bolted Cable Connections Program will verify that aging of metallic cable connections has not occurred and that installation and maintenance have been effective.

UFSAR Supplement. In LRA, Section A.2.1.40, the applicant provided the UFSAR supplement for the Bolted Cable Connections Program focusing on the metallic parts of the cable connections. This sampling program provides a one-time inspection to verify that the loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation is not an aging issue requiring a periodic AMP. A representative sample of the electrical cable connection population subject to an AMR will be inspected or tested. Connections covered under the EQ program or connections inspected or tested as part of a preventive maintenance program are excluded from an AMR. 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 selection will be documented. The applicant committed (Commitment No. 42) to implement this program prior to the period of extended operation.

The staff reviewed the UFSAR supplement, and determines that it provides a 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 program, 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). On the basis of its review of the UFSAR supplement for this program, the staff also finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 Quality Assurance Program Attributes Integral to Aging Management Programs

Pursuant to 10 CFR 54.21(a)(3), the applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended function(s) will be maintained consistent with the CLB for the period of extended operation. SRP-LR, Branch Technical Position (BTP) RLSB-1, "Aging Management Review - Generic," describes ten elements of an acceptable AMP. Elements (7), (8), and (9) are associated with the QA activities of "corrective actions," "confirmation process," and "administrative controls." BTP RLSB-1 Table A.1-1, "Elements of an Aging Management Program for License Renewal," provides the following description of these program elements:

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

(8) Confirmation Process - The confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions are completed and effective.

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

BTP IQMB-1, "Quality Assurance for Aging Management Programs," notes that AMP aspects that affect the quality of safety-related SSCs are subject to the QA requirements of 10 CFR Part 50, Appendix B. Additionally, for nonsafety-related SCs subject to an AMR, the applicant may use the existing 10 CFR Part 50, Appendix B, QA program to address the elements of "corrective actions," "confirmation process," and "administrative controls." BTP IQMB-1 provides the following guidance on the QA attributes of AMPs:

- Safety-related SCs are subject to 10 CFR Part 50, Appendix B, 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, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B, 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 commitment in the UFSAR supplement in accordance with 10 CFR 54.21(d).

3.0.4.1 Summary of Technical Information in the Application

LRA Sections A.2.1, "Aging Management Programs and Activities," and B.0.3, "Corrective Actions, Confirmation Process and Administrative Controls," describe the elements of corrective action, confirmation process, and administrative controls applied to AMPs for both safety-related and nonsafety-related components. A single QA program includes all three elements. Corrective actions, confirmation, and administrative controls are applied in accordance with the Corrective Action Program regardless of component safety classification. Specifically, LRA Sections A.2.1 and B.0.3, respectively, state that the QA Program implements the requirements of 10 CFR Part 50, Appendix B, and is consistent with the SRP-LR.

LRA Section B.1, "Aging Management Review Results," summarizes the AMR for each unique component type or commodity group requiring aging management during the period of extended operation.

3.0.4.2 Staff Evaluation

Applicants are required by 10 CFR 54.21(a)(3) to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that intended functions will be maintained consistent with the CLB for the period of extended operation. SRP-LR, Branch Technical Position RLSB-1, "Aging Management Review - Generic," describes ten attributes of an acceptable AMP. Three of these ten attributes are QA activities of corrective action, confirmation process, and administrative control. Table A.1-1, "Elements of an Aging Management Program for License Renewal," of Branch Technical Position RLSB-1 describes these quality attributes:

- Corrective actions, including root cause determination and prevention of recurrence, should be timely
- The confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective
- Administrative controls should provide for a formal review and approval process

SRP-LR, BTP IQMB-1 noted that AMP aspects that affect safety-related SSC quality are subject to the QA requirements of 10 CFR Part 50, Appendix B. Additionally, for nonsafety-related SCs subject to an AMR, the applicant's 10 CFR Part 50, Appendix B, QA program may address the elements of corrective action, confirmation process, and administrative control. BTP IQMB-1 provides the following guidance on the QA attributes of AMPs:

> Safety-related SCs are subject to Appendix B to 10 CFR Part 50 requirements which are adequate to address all quality related aspects of an AMP consistent with the CLB of the facility for the period of extended operation. For nonsafety-related SCs that are subject to an AMR for license renewal, an applicant has an option to expand the scope of its Appendix B to 10 CFR Part 50 program to include these SCs to address corrective action, confirmation process, and administrative control for aging management during the period of extended operation. In this case, the applicant should document such a commitment in the Final Safety Analysis Report supplement in accordance with 10 CFR 54.21(d).

The staff reviewed the AMPs described in LRA Appendices A and B and the LRPDs for consistency of the quality assurance attributes (corrective action, confirmation process, and administrative controls) with the staff's guidance in SRP-LR Section A.2, "Quality Assurance for Aging Management Programs (Branch Technical Position IQMB-1)."

Based on its review, the staff finds the descriptions of the AMPs and their quality attributes in LRA Sections A.2.1 and Section B.0.3 consistent with the staff's position on QA for aging management; however, the description of the corrective action attribute in the LRPDs did not credit the 10 CFR Part 50, Appendix B, QA program.

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's AMR results. The applicant responded to the staff's RAI as discussed below.

In RAI 3.0-X dated July 25, 2006, the staff submitted to the applicant a request to supplement the LRA to clarify that the same corrective action program will be applied to all AMPs and that this program meets the requirements of 10 CFR Part 50, Appendix B.

In its response dated August 22, 2006, the applicant further described the application of the 10 CFR Part 50, Appendix B, QA Program for corrective action, confirmation process, and administrative controls, and revised the UFSAR supplement. The revision stated, in part:

> The corrective action controls of the Entergy (10 CFR Part 50, Appendix B) Quality Assurance Program are applicable to all aging management programs that will be required during the period of extended operation.

The staff reviewed the proposed revision to UFSAR supplement, Appendix A, and on the basis of this clarification that the same corrective action program meeting 10 CFR Part 50, Appendix B requirements will be applied to all AMPs, the staff finds that the applicant has adequately addressed the staff's RAI. Therefore, the staff's concern described in RAI 2.1-3 is resolved.

3.0.4.3 Conclusion

On the basis of the staff's evaluation of the descriptions and applicability of the plant-specific AMPs and their quality attributes in LRA Sections A.2.1, B.0.3 and B.1 and the RAI response consistent with the staff's position on 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 Systems

This section documents the staff's review of the applicant's AMR results for the reactor vessel, reactor vessel internals, and reactor coolant system (RCS) components and component groups of the following:

- reactor vessel
- reactor vessel internals
- reactor coolant pressure boundary

3.1.1 Summary of Technical Information in the Application

LRA Section 3.1 provides AMR results for the reactor vessel, internals, and RCS components and component groups. LRA Table 3.1.1, "Summary of Aging Management Evaluations for the Reactor Coolant System," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the 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, 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 confirm the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL 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, In order to confirm 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 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 3.1.2.3.

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/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	AMP in LRA	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)	TLAA	Consistent with GALL Report, which recommends further evaluation (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	TLAA	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.1.2.2.1)
Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor coolant pressure boundary piping, piping components, and piping elements exposed to reactor coolant (3.1.1-3)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	TLAA	Consistent with GALL Report, which recommends further evaluation (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	TLAA	Consistent with GALL Report, which recommends further evaluation (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)	TLAA	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.1.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Nickel Alloy tubes and sleeves in a reactor coolant and secondary feedwater/steam environment (3.1.1-6)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Not applicable	Not applicable to BWRs
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)	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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	Water Chemistry Control – BWR (B.1.32.2), Inservice Inspection (B.1.16.2), and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.1.2.2.2)
Steel steam generator shell assembly exposed to secondary feedwater and steam (3.1.1-12)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Not applicable	Not applicable to BWRs
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	Water Chemistry – BWR (B.1.32.2); or Water Chemistry – BWR (B.1.32.2), Inservice Inspection (B.1.16.2), and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.1.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds (3.1.1-14)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Water Chemistry – BWR (B.1.32.2); or Water Chemistry – BWR (B.1.32.2), Inservice Inspection (B.1.16.2), and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (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	Water Chemistry – BWR (B.1.32.2); or Water Chemistry – BWR (B.1.32.2), Inservice Inspection (B.1.16.2), and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (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 steam generator, if general and pitting corrosion of the shell is known to exist, additional inspection procedures are to be developed.	Not applicable	Not applicable to BWRs
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 Appendix G of 10 CFR 50 and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations.	TLAA	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.1.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	Reactor Vessel Surveillance (B.1.26)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.1.2.2.3)
Stainless steel and nickel alloy top head enclosure vessel flange leak detection line (3.1.1-19)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	A plant-specific aging management program is to be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC in the vessel flange leak detection line.	Water Chemistry – BWR (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (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	Not applicable	Not applicable (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	Not applicable	Not applicable to BWRs
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.	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Stainless steel reactor vessel closure head flange leak detection line and bottom-mounted instrument guide tubes (3.1.1-23)	Cracking due to stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Not applicable	Not applicable to BWRs
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 aging management program	Not applicable	Not applicable to BWRs
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.	None for the portion of the jet pump sensing lines inside the RPV. Water Chemistry – BWR (B.1.32.2) and One-Time Inspection (B.1.23) for the portion of the jet pump sensing lines outside the RPV.	Consistent with GALL Report, which recommends further evaluation (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	Not applicable	Not applicable (See SER Section 3.1.2.2.8)
Stainless steel and nickel alloy reactor vessel internals screws, bolts, tie rods, and hold-down springs (3.1.1-27)	Loss of preload due to stress relaxation	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.	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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.	Not applicable	Not applicable to BWRs
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.	BWR Vessel Internals (B.1.8)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.1.2.2.11)
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.	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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 supp commitment to implement applicable plant commitments to (1) NRC Orders, Bulletins, and Generic Letters associated with nickel alloys and (2) staff-accepted industry guidelines.	Not applicable	Not applicable to BWRs
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..	Not applicable	Not applicable to BWRs
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.	Not applicable	Not applicable to BWRs
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.	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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.	Not applicable	Not applicable to BWRs
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.	Not applicable	Not applicable to BWRs
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.	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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 CR Drive Return Line Nozzle	BWR CRD Line Nozzle (B.1.3)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant (3.1.1-39)	Cracking due to cyclic loading	BWR Feedwater Nozzle	BWR Feedwater Nozzle (B.1.4)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
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	BWR Penetrations (B.1.5) and Water Chemistry – BWR (B.1.32.2) or BWR Vessel Internals (B.1.8) and Water Chemistry – BWR (B.1.32.2)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds (3.1.1-41)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	BWR Stress Corrosion Cracking (B.1.6) and Water Chemistry – BWR (B.1.32.2); or Inservice Inspection (B.1.16.2) and Water Chemistry – BWR (B.1.32.2); or Water Chemistry – BWR (B.1.32.2), Inservice Inspection (B.1.16.2), and BWR Stress Corrosion Cracking (B.1.6); or Water Chemistry - BWR (B.1.32.2), and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	BWR Vessel ID Attachment Welds (B.1.7) and Water Chemistry – BWR (B.1.32.2)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
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	BWR Vessel Internals (B.1.8) and Water Chemistry – BWR (B.1.32.2)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
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	BWR Vessel Internals (B.1.8) and Water Chemistry – BWR (B.1.32.2)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
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	Flow-Accelerated Corrosion Program (B.1.14)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
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	Not applicable	Not applicable
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	Water Chemistry – BWR (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel and stainless steel Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant (3.1.1-48)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping	Inservice Inspection (B.1.16.2) and Water Chemistry – BWR (B.1.32.2) or Water Chemistry – BWR (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
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	BWR Vessel Internals (B.1.8) and Water Chemistry – BWR (B.1.32.2)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
High-strength low alloy steel top head closure studs and nuts exposed to air with reactor coolant leakage (3.1.1-50)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Reactor Head Closure Studs	Reactor Head Closure Studs (B.1.25) or Bolting Integrity (B.1.33)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
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	Thermal Aging Embrittlement of CASS (B.1.31)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
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	Bolting Integrity (B.1.33)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel piping, piping components, and piping elements exposed to closed cycle cooling water (3.1.1-53)	Loss of material due to general, pitting and crevice corrosion	Closed-Cycle Cooling Water System	Not applicable	Not applicable
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	Not applicable	Not applicable
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.	Inservice Inspection (B.1.16.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)
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	Selective Leaching (B.1.27)	Not applicable
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	One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.1.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
Stainless steel flux thimble tubes (with or without chrome plating) (3.1.1-60)	Loss of material due to Wear	Flux Thimble Tube Inspection	Not applicable	Not applicable to BWRs
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)	Not applicable	Not applicable to BWRs
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)	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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)	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Nickel alloy steam generator tubes and sleeves exposed to phosphate chemistry in secondary feedwater/steam (3.1.1-77)	Loss of material due to wastage and pitting corrosion	Steam Generator Tube Integrity and Water Chemistry	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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 Bulletin 88-02.	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Stainless steel steam generator primary side divider plate exposed to reactor coolant (3.1.1-82)	Cracking due to stress corrosion cracking	Water Chemistry	Not applicable	Not applicable to BWRs
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	Not applicable	Not applicable to BWRs
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).	Not applicable	Not applicable to BWRs
Nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.1.1-85)	None	None	Not applicable	Not applicable
Stainless steel piping, piping components, and piping elements exposed to air - indoor uncontrolled (External); air with borated water leakage; concrete; gas (3.1.1-86)	None	None	Not applicable	Not applicable

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel piping, piping components, and piping elements in concrete (3.1.1-87)	None	None	Not applicable	Not applicable

3.1.2.1 AMR Results That Are Consistent with the GALL Report

LRA Section 3.1.2.1 identifies the materials, environments, and AERMs, and the following programs that manage aging effects for the reactor vessel, reactor vessel internals, and RCS components:

- BWR CRD Return Line Nozzle Program
- BWR Feedwater Nozzle Program
- BWR Penetrations Program
- BWR Stress Corrosion Cracking Program
- BWR Vessel ID Attachment Welds Program
- BWR Vessel Internals Program
- Flow-Accelerated Corrosion Program
- Inservice Inspection Program
- One-Time Inspection Program
- Reactor Head Closure Studs Program
- Reactor Vessel Surveillance Program
- System Walkdown Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program
- Water Chemistry Control - BWR Program
- Water Chemistry Control - Closed Cooling Water Program

LRA Tables 3.1.2-1 through 3.1.2-3 summarize AMRs for the reactor vessel, reactor vessel internals, and RCS components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency 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 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 AMP. The staff audited these line items to verify consistency with the GALL Report and verified that the identified exceptions to the GALL AMPs have been reviewed and accepted. The staff also determines whether the applicant's AMP was consistent with the GALL 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 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 determines 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 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 AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL 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 determines whether the credited AMP would manage the aging effect consistently with the GALL AMP and whether the AMR was valid for the site-specific conditions.

The staff audited and reviewed the information provided 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 AMRs. The staff's evaluation follows:

3.1.2.1.1 Cracking Due to Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, Cyclic Loading

In the discussion column of LRA Table 3.1.1, item 3.1.1-40, the applicant stated that cracking, in

SS and nickel-alloy RV nozzles and penetrations, is managed by the Water Chemistry Control – BWR and either the BWR Penetrations or BWR Vessel Internals program. During the audit and review, the staff noted that for two AMR result lines pointing to LRA Table 3.1.1, item 3.1.1-40 refer to Note E and summarize AMR results for the CRD stub tubes and the incore housings.

The staff reviewed the AMR result lines referring to Note E and determined that the material, environment, and effects of aging are consistent with those of the corresponding lines of the GALL Report; however, where the GALL Reports recommends the BWR Penetrations AMP evaluated in SER Section 3.0.3.2.4, the applicant proposed the BWR Vessel Internals AMP evaluated in SER Section 3.0.3.2.7. The staff asked why the applicant included components of these lines in the BWR Vessel Internals Program rather than the BWR Penetrations Program as recommended by the GALL Report.

In its response, the applicant stated that the BWR Penetrations Program is consistent with the GALL Report, Section XI.M8, BWR Penetrations, which covers only the standby liquid control (SLC)/core plate differential pressure nozzles and the instrument penetrations as addressed in BWRVIP-27 and BWRVIP-49, respectively. The applicant stated that it includes the CRD stub tubes and instrument housings in the BWR Vessel Internals Program because they are covered by BWRVIP-47, "Lower Plenum," which is included in GALL Report, Section XI.M9, "BWR Vessel Internals." The applicant stated that this inclusion is slightly inconsistent with GALL Report Section IV but concluded that it was better to be consistent with the programs in GALL Report Section XI rather than with one line item in GALL Report Section IV. The applicant also stated that both the BWR Penetrations Program and the BWR Vessel Internals Program are implemented by the same plant procedure.

The staff reviewed the applicant's response together with the applicable GALL AMPs and the related BWRVIP documents. The staff determines that the GALL Report does not refer to BWRVIP-47 in its description of the BWR Penetrations AMP; however, the GALL Report does include BWRVIP-47 in its description of the BWR Vessel Internals Program. On this basis, the staff finds acceptable the applicant's use of Water Chemistry Control – BWR and BWR Vessel Internals programs for aging management of the CRD stub tubes and incore instrument housings.

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 found that the applicant addressed the aging effect/mechanism (AEM) appropriately as recommended by the GALL Report.

3.1.2.1.2 Cracking Due to Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking

In the discussion column of LRA Table 3.1.1, item 3.1.1-41, the applicant stated that cracking in SS, nickel-alloy, and steel clad with SS components in reactor coolant is managed by several programs. The applicant stated that, consistent with the GALL Report for some components of the RV and RCPB, the BWR Stress Corrosion Cracking and Water Chemistry Control – BWR programs, further supplemented by the Inservice Inspection Program for some components, manage cracking and that for other components not subject to the BWR Stress Corrosion Cracking Program cracking is managed by the Water Chemistry Control – BWR and Inservice Inspection or One-Time Inspection programs. During the audit and review, the staff noted that, five AMR result lines pointing to LRA Table 3.1.1, item 3.1.1-41, included a reference to Note E.

Four lines that refer to Note E summarize AMR results for which the AMPs are the Water Chemistry Control – BWR and the Inservice Inspection programs. One line that refers to Note E summarizes AMR results for which the AMPs are the Water Chemistry Control – BWR and the One-Time Inspection programs.

The staff reviewed the AMR result lines referring to Note E, where the AMPs are the Water Chemistry Control – BWR and the Inservice Inspection programs, and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report. During the audit and review, the staff noted that the only components identified in these lines are either vessel nozzles of low-alloy steel with SS cladding or SS and nickel alloy safe ends for vessel penetration nozzles included in the BWR Penetrations Program. The staff noted that the GALL Report recommends use of the BWR Stress Corrosion Cracking and Water Chemistry programs for aging management of these components. The staff asked the applicant to explain why these components were subject to the Inservice Inspection Program rather than to the BWR Stress Corrosion Cracking Program.

In its response, the applicant stated that it chose to include these components in the Inservice Inspection Program, rather than the BWR Stress Corrosion Cracking Program, for implementation documenting purposes. The applicant stated in the BWR Stress Corrosion Cracking Program that the Inservice Inspection Program will be enhanced to specify that the GL 88-01 or approved BWRVIP-75 guidelines shall be considered in sample expansion if indications are found in GL 88-01 welds.

The Inservice Inspection Program therefore, includes the necessary elements of the BWR Stress Corrosion Cracking Program and the staff finds the use of the Inservice Inspection Program acceptable. Based on this determination, the staff finds the applicant's use of Note E appropriate and these AMR result lines acceptable.

The staff reviewed the AMR result line referring to Note E, where the AMPs are the Water Chemistry Control – BWR and the One-Time Inspection Programs and determines that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report. The staff noted that the only component identified in this line is the main steam (MS) line flow restrictor made of CASS in an environment of treated water at greater than 482°F. By review of ASME Code Section XI, Table IWB-2500-1, and the applicant's ISI implementing procedures the staff determines that the MS line flow restrictors need not be included in the Inservice Inspection Program because they are inside the MS lines and not parts of the RCPB. Accordingly, the MS line flow restrictors are not inspected routinely in the Inservice Inspection Program, and partial disassembly of the MS lines is required for inspection access. The staff noted that the GALL Report recommends the Water Chemistry Program augmented by One-Time Inspection Program to confirm effectiveness as appropriate AMPs to manage the aging effects of other components with materials, environments and effects of aging similar to those of the MS line flow restrictors. The staff's evaluation of these programs is documented in SER Sections 3.0.3.1.13 and 3.0.3.1.8, respectively. On this basis, the staff finds the applicant's use of Note E appropriate and finds these AMR result lines 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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.1.2.1.3 Loss of Material Due to Pitting and Crevice Corrosion

In the discussion column of LRA Table 3.1.1, item 3.1.1-47, the applicant stated that loss of material in SS and nickel-alloy components of the RV internals is managed by the Water Chemistry Control – BWR Program and that the One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program to manage loss of material. The applicant stated that the Inservice Inspection Program does not apply to most RV internals components because they are not parts of the pressure boundary and that management of loss of material by the Water Chemistry Control – BWR Program augmented by the One-Time Inspection Program is consistent with other LRA Table 3.1.1, including items 3.1.1-14 and 3.1.1-15. During the audit and review, the staff noted that all of the AMR result lines pointing to LRA Table 3.1.1, item 3.1.1-47, refer to Note E. The staff noted that the components described by the AMR result lines are BWR internal components that are not part of the RCPB in an environment of hot treated water (reactor coolant) and that the AMP was Water Chemistry Control – BWR.

During the audit and review, the staff noted that the LRA's discussion for Table 3.1.1, item 3.1.1-47, states that the One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program. The staff asked the applicant to explain why, for management of loss of material in these components, PNPS does not list the Inservice Inspection Program as recommended in the corresponding line of the GALL Report.

In its response, the applicant stated that it does VT-3 examinations of the vessel interior as required by ASME Code Section XI, Table IWB-2500-1 (Examination Category B-N-1, interior of reactor vessel). The applicant also stated that these examinations do not include most of the BWR internal components and that, therefore, to credit ISI for managing loss of material of the internals in general is inappropriate. The applicant stated that ASME Examination Category B-N-3 (removable core support structures) does not apply to PNPS, which has no removable core support structures. The applicant further stated that the AMR result lines that roll up to LRA Table 3.1.1, item 3.1.1-47 (GALL Report, Table IV, Item IV.A1-8) are for loss of material due to pitting and crevice corrosion and that the GALL Report repeatedly credits the Water Chemistry Control – BWR Program augmented by the One-Time Inspection Program to manage loss of material due to pitting and crevice corrosion. The applicant stated that this program combination is adequate to manage the aging effect in that the loss of material due to pitting and crevice corrosion for the reactor internals is no different from the loss of material due to pitting and crevice corrosion for other SS components exposed to reactor coolant. The applicant stated that the effectiveness of the Water Chemistry Control - BWR Program is confirmed by the One-Time Inspection Program and that the One-Time Inspection Program will incorporate the results of other inspections, including ISI inspections per ASME Code Section XI, Table IWB-2500-1, and other opportunistic inspections.

The staff reviewed the applicant's response together with ASME Code Section XI, Table IWB-2500-1, Examination Category B-N-1, requirements. On the basis that the ISI examinations are performed per the requirements of ASME Section XI, IWB-2500-1, and that the effectiveness of the Water Chemistry Control - BWR program to manage the aging effect of loss of material due to pitting and crevice corrosion is confirmed by the One-Time Inspection Program. The staff's evaluation of these programs is documented in SER Sections 3.0.3.1.13 and 3.0.3.1.8, respectively. On this basis staff finds the applicant's response 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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.1.2.1.4 Cracking Due to Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, (for SS only), and Thermal and Mechanical Loading

In the discussion column of LRA Table 3.1.1, item 3.1.1-48 (steel and SS Class 1 piping, fittings and branch connections less than 4-inches NPS exposed to reactor coolant), the applicant stated that cracking of SS RCPB components exposed to reactor coolant is managed by the Water Chemistry Control – BWR Program and that the One-Time Inspection Program, which is consistent with GALL AMPs XI.M32, "One-Time Inspection," and XI.M35, "One-Time Inspection of ASME Code Class 1 Small Bore Piping," will verify the effectiveness of the Water Chemistry Program and manage cracking in piping and fittings less than 4-inches NPS. The applicant stated that cracking in steel components due to thermal and mechanical loading is not directly dependent on water chemistry so only the One-Time Inspection Program is credited. The applicant stated that ISI does not apply to components less than 4-inches NPS and that AMR result lines referring to this line of Table 3.1.1 use either One-time inspection or ISI, but not both, as listed in the GALL Report, so Note E is used for these AMR result lines. During the audit and review, the staff noted that the components referring to Table 3.1.1, item 3.1.1-48, are piping and fittings, valve bodies and thermowells less than 4-inches NPS, plus other specialized piping components (*e.g.*, filter housings, orifices, condensing chambers, and accumulator tanks) for which the NPS was not listed. The staff noted that the applicant referred to Note E for all of these components.

During the audit and review, the staff noted that the applicant's discussion for Table 3.1.1, item 3.1.1-48, states that, "Inservice inspection does not apply to components less than 4-inches NPS." The staff also noted that ASME Code Section XI, Table IWB-2500-1, Examination Category B-J (pressure-retaining welds in piping), requires surface but not volumetric examination for Class 1 piping less than 4-inches NPS. The staff asked the applicant to reconcile the discussion for Table 3.1.1, item 3.1.1-48, with the ASME Code Section XI requirement.

In its response dated July 19, 2006, the applicant revised the discussion of LRA Table 3.1.1, item 3.1.1-48, to delete the statement that, "Inservice inspection is not applicable to components less than 4-inches NPS."

Because this change eliminates the conflict between the LRA and ASME Code Section XI and that examination requirements of ASME Code Section XI for components less than 4-inches NPS apply, the staff finds the applicant's response acceptable.

During the audit and review, the staff noted that LRA Table 3.1.1, item 3.1.1-48, applies to Class 1 piping, fittings, and branch lines less than 4-inches NPS both of carbon steel and of SS; however, there were no AMR result lines for carbon steel piping, fittings or branch lines less than 4-inches NPS pointing to LRA Table 3.1.1, Item 3.1.1-48. The staff asked the applicant to explain why there were no Class 1 carbon steel piping components less than 4-inches NPS in the AMR results.

In its response, the applicant provided the following response:

> Cracking due to flaw growth is managed by the inspection requirements for Class 1 components in accordance with ASME Section XI, Subsection IWB. Cracking due to flaw growth is considered equivalent to the GALL Report's entry of cracking due to thermal and mechanical loading. The ISI program applies to Class 1 carbon steel piping components at PNPS.
>
> The LRA will be clarified to show that cracking is an aging effect requiring management for Class 1 carbon steel components less than 4-inches NPS at PNPS. The discussion column for Item 3.1.1-48 will be revised to be consistent with this change. The credited AMPs will be the same as those listed for the NUREG-1801 line items corresponding to LRA Table 3.1.1, Item 3.1.1-48.

In its response dated July 19, 2006, the applicant revised the LRA to delete the statement, "Cracking in steel components due to thermal and mechanical loading is not directly dependent on water chemistry, so only the One-Time Inspection Program is credited." In addition, the applicant revised LRA Table 3.1.2-3 by adding line items for carbon steel piping and fittings less than 4-inches NPS in a treated water environment and in a treated water environment greater than 220°F. For both lines, the applicant credited the One-Time Inspection Program with managing the aging effect of cracking.

The staff reviewed the applicant's changes to the LRA and determined that the AMR results for Class 1 carbon steel piping components less than 4-inches NPS exposed to reactor coolant are consistent with the recommendations of the GALL Report. On that basis the staff finds the applicant's LRA changes acceptable.

During the audit and review, the staff asked the applicant to describe its plans for examination of socket welds in small-bore piping.

In its response dated September 13, 2006, the applicant stated in Commitment No. 20 that the One-Time Inspection Program will include destructive or nondestructive examination of one socket-welded connection by techniques proven by industry experience as effective for detection of cracking in small-bore socket welds. The applicant stated that if there is no inspection opportunity (*e.g.*, socket weld failure or socket weld replacement), a susceptible small-bore socket weld will be examined either destructively or nondestructively before the period of extended operation.

During the January 18, 2007, Advisory Committee on Reactor Safeguards (ACRS) Subcommittee Meeting on Plant License Renewal of Oyster Creek Generating Station the staff addressed the examination of socket welds as follows:

> "What the issue is for Class 1 socket welds, Class 1 and Class 2 socket welds, less than four inch nominal pipe size, should they be included in the one-time inspection of small bore piping. The GALL report does not include them. [The staff] had extensive discussions... on this issue, and ...concluded [that] currently IWB and IWC require a surface exam for socket welds, between one and four inches. There's no requirement for socket welds under one inch, and all of Oyster Creek's socket welds are under one inch. [The staff] looked at the literature and ...found out that most failures are vibrational

> fatigue, and they initiate on the ID. So doing a surface exam doesn't really help you much, and the NRC position is if its ID initiated doing a surface exam is not appropriate even though its in the code, and they've been granting relief to use a VT-2 or visual exam. So the conclusion [the staff] drew was that looking at one or even several socket welds will not really prove very much, and so that [the staff is] not going to require socket welds be examined."

The ACRS agreed with the staff's position and subsequently PNPS, in letter dated February 23, 2007, removed all references to socket welds from Commitment No. 20.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.1.2.1.5 Cracking Due to Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking (IASCC)

The discussion column of LRA Table 3.1.1, item 3.1.1-49, states "PNPS has welded access hole covers with a crevice behind the weld. Cracking of the nickel-alloy shroud support access hole covers is managed by the BWR Vessel Internals and Water Chemistry Control – BWR Programs as described in line item 3.1.1-44. The BWR Vessel Internals Program augments the Inservice Inspection Program and includes either access hole cover visual examinations every 8 years or ultrasonic examination every 12 years." During the audit and review, the staff noted that LRA Table 3.1.2-2 shows two complementary AMR result lines for the shroud support access hole covers. One lists the Water Chemistry Control – BWR Program and the second the BWR Vessel Internals Program as an AMP for the access hole covers. The staff noted that the applicant referred to Note E for the AMR result line listing the Water Chemistry Control – BWR AMP.

During the audit and review, the staff noted that the GALL Report, Volume 1, Table 1, item 49, recommends an augmented inspection using UT or other demonstrably acceptable inspection for managing the aging effect of cracking in welded, creviced access hole covers. The staff asked the applicant whether the welded access hole covers are creviced, whether it examines the access hole covers by UT, and whether it plans to examine the access hole covers by UT during the period of extended operation.

In its response, the applicant provided the following response:

> The original equipment vendor issued a service information letter (SIL) in 1988 after stress corrosion cracking was found in a creviced access hole cover fabricated of nickel alloy. The SIL and its subsequent supplements provided recommendations with regard to inspection of creviced access hole cover welds. In response to the SIL's recommendations, PNPS performed UT examinations of both access hole covers at its RFOs [refueling outages] in 1991 and 1993, and it performed a UT examination of one access hole cover plus a visual inspection (VT-1) of both access hole covers at its RFO in 1995. No indications were found in any of these examinations. The original equipment vendor updated its SIL in 2001 based on more recent industry experience and provided recommendations for access hole cover inspection methods and schedules that are currently still in

effect. Although PNPS has implemented hydrogen water chemistry to mitigate potential for cracking due to IGSCC, PNPS currently follows the original equipment manufacturer's recommendations that are applicable to a nonhydrogen water chemistry plant. In 2003, PNPS performed an enhanced visual examination (EVT-1) of both access hole covers. In 2005, PNPS did not perform any examinations. In 2007, PNPS plans to perform a VT-1 examination of one access hole cover, and in 2009, PNPS plans to perform a VT-1 examination of the alternate access hole cover.

PNPS will continue to inspect the two access hole covers visually, one at a 4-year interval and one at a 6-year interval, respectively, during the current licensing period. If new BWRVIP guidance is issued for these components, PNPS will perform inspections in accordance with that guidance.

Within the first 6 years of the period of extended operation and every 12 years thereafter, PNPS will inspect the access hole covers with UT methods. Alternatively, PNPS will inspect the access hole covers in accordance with future BWRVIP guidance, should such guidance become available.

In a letter dated September 13, 2006, the applicant included the UT inspection of the access hole covers during the period of extended operation, as described in its response, as Commitment No. 34.

The staff reviewed the applicant's response, the original equipment vendor SIL (GE Nuclear Energy SIL 462, Revision 1, "Access Hole Cover Cracking"), and the applicant's license renewal commitment as documented in its September 13, 2006, response. The staff noted that for inspection of the access hole cover, the applicant credits the BWR Vessel Internals Program rather than the Inservice Inspection Program as described in the GALL Report; however, the inspection methods of both programs are equivalent for components included. Based on its review of the applicant's response, commitment letter, and related documentation, the staff determines that the applicant's current examination of the shroud support access hole covers is consistent with current vendor recommendations applicable to PNPS and that the applicant's proposed examination of the shroud support access hole covers during the period of extended operation will use UT examination or other demonstrably acceptable inspection methods as recommended in the GALL Report. The staff evaluated the AMPs credited for managing the effects of aging in SER Sections 3.0.3.2.7 (BWRVIP) and 3.0.3.1.13 (Water Chemistry Control-BWR Program). On the basis that the applicant's AMPs for the access hole covers are consistent with those of the GALL Report with recommended examinations as parts of the BWR Vessel Internals Program rather than the Inservice Inspection Program, the staff finds the applicant's AMR results and its use of Note E for these components 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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.1.2.1.6 Cracking Due to Stress Corrosion Cracking, and Intergranular Stress Corrosion Cracking

In the discussion column of LRA Table 3.1.1, item 3.1.1-50, the applicant stated that the Reactor Head Closure Studs Program manages cracking in low-alloy steel head closure flange bolting and that the Inservice Inspection Program manages cracking in other low-alloy steel pressure boundary bolting. During the audit and review, the staff noted that LRA Table 3.1.2-1 shows two AMR result lines referring to LRA Table 3.1.1, item 3.1.1-50. One line, applicable to the top head closure flange studs, nuts, washers, and bushings, shows material, environment, aging effect, and AMP all consistent with recommendations of the GALL Report. The second line, applicable to other pressure boundary bolting attached directly to the RPV, shows material, environment, and aging effect consistent with those of the GALL Report; however, the AMP is shown is the Inservice Inspection Program rather than the Reactor Head Closure Studs Program. The staff noted that the applicant referred to Note E in the second of these AMR result lines.

Originally, the applicant did not include a Bolting Integrity Program in the LRA. Instead, the applicant credited alternate programs like the System Walkdown, Service Water Integrity, and Buried Piping and Tanks Inspection. The GALL AMP XI.M18, "Bolting Integrity," makes several recommendations in the 10-element evaluation (*e.g.*, selection of bolting materials, use of lubricants and sealants) and additional NUREG-1339 recommendations. The alternate programs may be acceptable for inspection but do not address preventive actions. The staff asked the applicant to clarify how it meets these recommendations or to explain why there should be no bolting integrity program.

In its response dated July 19, 2006, the applicant included "Bolting Integrity Program," which is consistent with GALL AMP XI.M18, "Bolting Integrity," and which covers bolting within the scope of license renewal, including: (1) safety-related bolting, (2) bolting for nuclear steam supply system(NSSS) component supports, (3) bolting for other pressure-retaining components, including nonsafety-related bolting; and (4) structural bolting (actual measured yield strength greater than 150 ksi). The aging management of reactor head closure studs addressed by GALL AMP XI.M3 is not included in this program. Therefore, the aging effects of component type of bolting in all mechanical systems, except reactor head closure studs, are managed by the Bolting Integrity Program instead of any other program identified in LRA Table 3.1.2-2s.

The evaluation of this program is documented in SER Section 3.0.3.2.20. The staff reviewed both the Bolting Integrity Program and the Reactor Head Closure Studs Program and finds them 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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.1.2.1.7 Cracking Due to Stress Corrosion Cracking, Loss of Material Due to Wear, Loss of Preload Due to Thermal Effects, Gasket Creep, and Self-Loosening

LRA Table 3.1.1, item 3.1.1-52 shows the applicable AMP as "Inservice Inspection" rather than "Bolting Integrity," as specified in the GALL Report. During the audit and review the staff noted that the applicant had not included a Bolting Integrity AMP comparable to that described in the

GALL Report, Section XI.M18, “Bolting Integrity.” The staff asked the applicant for a Bolting Integrity AMP and the components to which it will apply during the period of extended operation.

As stated in SER Section 3.1.2.1.6, the applicant’s response dated July 19, 2006, included B.1.33, Bolting Integrity Program. This program is consistent with GALL AMP, XI.M18, “Bolting Integrity.” The evaluation of this program is documented in SER Section 3.0.3.2.20. The staff reviewed the program and finds it 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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.1.2.1.8 Loss of Fracture Toughness Due to Thermal Aging Embrittlement

In the discussion column of LRA Table 3.1.1, item 3.1.1-55, the applicant stated that the Inservice Inspection (ISI) Program manages the reduction of fracture toughness in CASS reactor coolant pressure boundary (RCPB) components. During the audit and review, the staff noted that LRA Table 3.1.2-3 shows three AMR result lines pointing to LRA Table 3.1.1, item 3.1.1-55, in which the applicant refers to Note E. These lines are for three component groups: CASS pump casings and covers in an environment of reactor coolant greater than 482°F, CASS valve bodies greater than 4-inches NPS in an environment of reactor coolant greater than 482°F, and CASS valve bodies less than 4-inches NPS in an environment of reactor coolant greater than 482°F. For the first two of these component groups, the applicant listed the aging effect of reduction in fracture toughness and the AMP as ISI. For the last of these component groups, the applicant listed the aging effect of reduction in fracture toughness and the AMP as the One-Time Inspection Program. GALL AMR line result IV.C2-6 (R-08) provides the corresponding AMR result line on reduction of fracture toughness in Class 1 pump casings and valve bodies made from CASS and recommends that the ISI Program be credited to manage this aging effect.

The staff noted that for the AMR result lines on reduction of fracture toughness in Class 1 pumps casings and large bore Class 1 valve bodies (≥ 4 inches NPS) made from CASS, the material, environment, effects of aging, and AMP in the AMRs were consistent with the material, environment, aging effect and AMP recommended in GALL AMR result line IV.C2-6. The staff reviewed the applicant’s description of the Inservice Inspection Program (AMP B.1.16.2) and noted that the applicant classified it as plant-specific because it is based on ASME Code Section XI, 1998 Edition with 2000 Addenda, consistent with the basis for the applicant’s fourth 10-year ISI interval, rather than on ASME Code Section XI, 2001 Edition with 2002 and 2003 Addenda, as in the GALL Report. The staff also noted that component examination requirements are identical in both the ASME Code edition/addenda cited by the applicant and in those cited by the GALL Report. On this basis, the staff finds it acceptable to credit the ISI Program to manage reduction of fracture toughness in these Class 1 pump casings and large bore Class 1 valve bodies (≥ 4 inches NPS) because it is meets the recommended position in GALL AMR result line IV.C2-6.

The staff noted that for the AMR result line on reduction of fracture toughness of the small bore Class 1 valve bodies (< 4 inches NPS) made from CASS, the material, environment, and aging effect are all consistent with those of the corresponding line of the GALL Report. However, where the GALL Report recommends the Inservice Inspection Program, the applicant credited the

One-Time Inspection Program to manage this aging effect. In a telephone conference dated May 10, 2007, the staff informed the applicant that it is unacceptable to credit only the One-time Inspection Program to manage reduction of fracture toughness in these small bore valve bodies because: (1) the valve bodies are Class 1 RCPB components, and (2) GALL AMP XI.M32, "One-Time Inspection," does not provide for any supplemental fracture toughness assessment if cracking is detected in a CASS component as a result of a one-time examination.

In its response dated May 17, 2007, the applicant amended AMR line result 3.1.1-55 and the applicable AMR line result in Table 3.1.2-3, and credited both the ISI Program and the One-time Inspection Program to manage reduction of fracture toughness in the small bore Class 1 valve bodies made from CASS. The staff finds the ISI acceptable for managing the reduction of fracture toughness in these valves because it is consistent with, GALL AMR line result IV.C2-6. The applicant's crediting of an additional one-time examination to detect cracking in these valve bodies goes beyond the position in GALL AMR line result IV.C2-6 and is both conservative and 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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.1.2.1.9 Loss of Fracture Toughness Due to Thermal Aging Embrittlement

In the discussion column of LRA Table 3.1.1, item 3.1.1-57, the applicant stated that the One-Time Inspection Program manages the reduction of fracture toughness in CASS MS flow restrictors. PNPS has no other CASS Class 1 piping, piping components, piping elements, or CRD housings. CASS pump casings and valve bodies are included in item 3.1.1-57. During the audit and review, the staff noted that LRA Table 3.1.2-3 shows only one AMR result line pointing to LRA Table 3.1.1, item 3.1.1-57, and that for this line the applicant referred to Note E. The staff noted that the AMR result line is for the CASS MS line flow restrictors in an environment of reactor coolant (steam) greater than 482°F and that the applicant listed the aging effect as reduction in fracture toughness and the AMP as the One-Time Inspection Program.

The staff noted that for the AMR result line the material, environment, and aging effect are all consistent with those of the corresponding line of the GALL Report. However, where the GALL Report recommends the Thermal Aging Embrittlement of CASS Program the applicant listed the One-Time Inspection Program. The staff noted the LRA statement that, except for the MS line flow restrictors, there are no other CASS Class 1 piping, piping components, piping elements, or CRD housings and that CASS pump casings and valves bodies are included in item 3.1.1-57. The staff also noted that in the AMR result line the intended function of the MS line flow restrictors is flow control rather than pressure boundary because the components are mounted inside the MS lines and are not parts of the RCPB routinely inspected by the ASME Code Section XI Inservice Inspection Program.

The staff reviewed GALL AMP XI.M12, "Thermal Aging Embrittlement of CASS," and the applicant's aging management program evaluation report (AMPER), which describes one-time inspection activities. For the MS line flow restrictors, the staff noted that the applicant's AMPER lists the parameters monitored/inspected as presence and extent of cracking, wall thickness, and reduction in fracture toughness (presence and extent of cracking). Based on its review of the

GALL AMP description and that of the One-Time Inspection Program documented in the AMPER, the staff determines that the examination methods that the applicant proposes for one-time inspection of the MS line flow restrictors are consistent with the examination recommendations in the GALL Report description of the Thermal Aging Embrittlement of CASS Program. On the basis that the applicant's proposed methods for detection of aging effects are consistent with what is described in the GALL Report's recommended AMP, the staff finds the applicant's AMP and the use of Note E for this AMR result line 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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.1.2.1.10 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 corrossion 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
- 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 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 3.1.2.2. 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). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

The applicant provided its AMRs for RPV components and for RPV nozzles and other RPV appurtenances in LRA Table 3.1.2-1. The applicant submitted its AMRs for the RPV internal components in LRA Table 3.1.2-2 and for the commodity groups in RCPB piping systems (*i.e.*, Class 1 safety-related piping) in LRA Table 3.1.2-3.

The staff reviewed AMR line items in the LRA Tables 3.1.2-1, 3.1.2-2, and 3.1.2-3 in which fatigue-induced damage ("cracking - fatigue" in the AMR line items) was an AERM and in which the "TLAA - Metal Fatigue" was credited for its management. This SER will refer to these AMR line items on Metal Fatigue of Class 1 components as "Class 1 Fatigue AMRs" and to this TLAA as the "TLAA on Metal Fatigue of Class 1 Components."

The staff determined that the scope of the applicant's TLAA on Metal Fatigue of Class 1 Components (refer to LRA Section 4.3) appeared not to cover all commodity groups in the Class 1 Fatigue AMRs for which the TLAA had been credited for aging management of fatigue-induced damage.

The staff asked the applicant to indicate which of the commodity groups in the AMR line items were designed in accordance with ASME Boiler and Pressure Vessel Code, Section III, the American National Standards Institute (ANSI) B31.1 design code (B31.1), or some other design code of record. For commodity groups designed to Section III, the staff requested reconciliation of the commodity groups in the Class 1 Fatigue AMRs with those analyzed for Section III cumulative usage factor (CUF) values in LRA Table 4.3-1. For commodity groups designed to B31.1, the staff asked the applicant to amend LRA Section 4.3.1 to include the same sort of B31.1 fatigue analysis for non-Class 1 B31.1 components in LRA Section 4.3.2. For commodity groups designed to a design code other than Section III or B31.1, the staff asked the applicant to clarify how the TLAA *on metal fatigue could manage fatigue-induced damage in the components* or to credit an inspection-based AMP with management of the aging effect.

In its response dated September 13, 2006, the applicant confirmed that all of the RPV components (including the RPV nozzles and other RPV appurtenances) were designed to ASME Boiler and Pressure Vessel Code, Section III. The applicant clarified that these components either had been analyzed for the current operation period in accordance with the CUF calculation methods of Section III or had been excluded from CUF calculations in accordance with the exclusion criteria of Paragraph N–415.1 of the 1965 Edition of Section III, the applicant's design code of record. Therefore, it is acceptable to credit the "TLAA on Metal Fatigue" as the basis for managing fatigue-induced damage of the RPV components because these components are within-scope of the Section III 1965 Edition Paragraphs N–415 or N–416 fatigue analyses of whether fatigue-induced damage could start in the components and because this is consistent with the GALL Report.

The staff review of the CUF calculations for the RPV components for the period of extended operation is in SER Section 4.3.1.2.1. This issue of the TLAA credited to manage fatigue-induced damage in the RPV components is closed.

In its response dated September 13, 2006, the applicant confirmed that the core shroud repair hardware assemblies (core shroud tie rod assemblies) were the only RPV internal components analyzed in accordance with a Section III CUF calculation for the current operating period.

Therefore, the staff concluded that the core shroud tie rods were the only RPV internal components for which the applicant could credit the TLAA on Metal Fatigue with aging management of fatigue-induced damage in the components. For the remaining commodity groups in the Class 1 Fatigue AMRs of the RPV internals, the applicant amended the AMR line items and credited the BWR Vessel Internals program to manage fatigue-induced damage (*i.e.*, fatigue-induced cracking) in the commodity groups including the following:

- control rod guide tubes
- core plate assemblies
- core spray lines
- fuel supports
- incore instrumentation and guide tubes
- jet pump assemblies
- core shroud and shroud support
- top guide assembly

The applicant's BWRVIP is a valid augmented inspection program to credit with management of cracking because it incorporates both NRC-mandated inspections of the RPV internals required by 10 CFR 50.55a and ASME Code Section XI, as well as augmented inspection and evaluation activities in accordance with NRC-approved, recommended BWRVIP guidelines.

The staff confirmed that these components are within the scope of the applicable BWRVIP reports that form the basis of the applicant's BWRVIP. Based on this analysis, the staff concludes that it is acceptable to credit the BWRVIP with aging management of fatigue-induced cracking in these RPV internal commodity groups. The applicant provided its BWRVIP in LRA Section B.1.8. The staff reviewed the BWRVIP and its evaluation is in SER Section 3.0.3.2.7. This issue is closed.

In its response dated September 13, 2006, the applicant confirmed that the RRS replacement piping had been procured to Section III and analyzed in accordance with a 40-year Section III CUF analysis. The staff review of the CUF analysis for the RRS piping loops is in SER Section 4.3.1.2.3. For the remaining Class 1 commodity groups in the metal fatigue AMRs of LRA Table 3.1.2-3, the applicant confirmed that all were designed to B31.1 with the exception of the (1) CRD detector, (2) CRD drives, (3) RRS pump casing and cover, and (4) MS line flow restrictors.

The staff evaluates how the applicant manages fatigue-induced damage in these commodity groups in the following paragraphs.

In its response dated September 13, 2006, the applicant amended the LRA to delete the Class 1 Fatigue AMR line item for the detector (CRD) in Table 3.1.2-3. The applicant clarified that the component, although within the scope of license renewal, requires no AMR because the detector is calibrated and checked periodically for functionality and operability.

The staff determined that this clarification is an acceptable basis for removal of this AMR from the LRA because the CRD detector is subject to periodic calibration and surveillance requirements. This issue of the CRD detector is closed.

In its response dated September 13, 2006, the applicant amended the Class 1 Fatigue AMR line item drives (CRD) in Table 3.1.2-3. to change the inside environment for the components to the "treated water < 270°F" environment and to delete fatigue-induced damage as an AERM. The applicant clarified that fatigue-induced damage is not considered to be an AERM for the CRD drives because the components operate at a temperature less than 250°F, and that this operating temperature is less than the applicant's thermal threshold of 270°F for inducing fatigue-induced damage in the components. The applicant clarified that initiation of fatigue-induced damage is not an applicable aging effect at temperature below 270°F. This is consistent with the environmental definitions for the LRA.

Based on this assessment, the staff concludes that the applicant's amended environment for the CRD drives and basis for concluding that fatigue-induced damage is not an AERM for the CRD drives are acceptable because the operating temperature is less than the threshold for inducing thermal fatigue in the components.

In its response dated September 13, 2006, the applicant amended the Class 1 Fatigue AMR line item for the pump and casing (RR) in Table 3.1.2-3. and credited the ISI program to manage fatigue-induced damage in the components. The ISI examinations for recirculation pumps are mandated by 10 CFR 50.55a and ASME Code Section XI Examination Categories BL1 and BL2. The examination categories require volumetric examinations of the pump casing welds once every inspection internal and visual VT-3 examinations of the casings and covers once every inspection interval. The volumetric examinations are capable of detecting any cracks in the welds. It is expected that any fatigue-induced damage, as initiated in the form of a fatigue-induced crack, would initiate in the pump welds.

Because the ISI examinations for the pump casing include volumetric examinations of the casing welds and visual examinations of the outside surfaces pump casing and cover base metal materials, the staff concludes that the ISI program is a valid AMP to credit to manage fatigue-induced damage in the components. The staff reviewed the Inservice Inspection Program and its evaluation is documented in SER Section 3.0.3.3.3.

In its response dated September 13, 2006, the applicant amended the Class 1 Fatigue AMR line item for the restrictors (MS) in Table 3.1.2-3. and credited the One-Time Inspection Program to manage fatigue-induced damage in the components. The applicant stated that the MS flow restrictors are non-pressure boundary components because they are welded internally to pipes serving as pressure-retaining components. Instead, the applicant stated that the MS flow restrictors are designed to limit the rate of radioactive steam release during a design-basis MS line break downstream of the MS flow restrictors.

The staff review of the One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3.1.8. The staff concludes that the program attributes for the applicant's One-Time Inspection Program are consistent with those of GALL AMP XI.M.32, "One-Time Inspection." For detection of cracking, GALL AMP XI.M.32 recommends inspections based on either volumetric examination methods or enhanced VT-1 visual examination methods. The staff agrees that the MS flow restrictors serve no RCPB function and that for the function to limit the rate of radioactive release during a postulated MS break, a one-time inspection using enhanced VT-1 visual examination (EVT-1) techniques is appropriate for determining whether fatigue-induced cracking has occurred.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.1.2.2.2 against the following SRP-LR Section 3.1.2.2.2 criteria:

(1) LRA Section 3.1.2.2.2 addresses the loss of material due to general, pitting, and crevice corrosion in RV steel components exposed to reactor coolant. The LRA states that the aging effect is managed by the Water Chemistry Control – BWR Program. The LRA adds that the effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including areas of stagnant flow. The Inservice Inspection Program supplements the Water Chemistry Control – BWR Program for these components.

SRP-LR Section 3.1.2.2.2 states that loss of material due to general, pitting, and crevice corrosion may occur in the steel pressurized water reactor (PWR) steam generator shell assembly exposed to secondary feedwater and steam. Loss of material due to general, pitting, and crevice corrosion also may occur in the steel top head enclosure (without cladding) top head nozzles (vent, top head spray or reactor core isolation cooling (RCIC), and spare) exposed to reactor coolant. The existing program controls reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

In the discussion column of LRA Table 3.1.1, items 3.1.1-11 and 3.1.1-14, the applicant stated that the Water Chemistry Control – BWR program, augmented by the One-Time Inspection Program to verify program effectiveness, will manage loss of material in carbon steel components and in RV SS, nickel-alloy, and steel with SS-clad components and that some of these components also credit the Inservice Inspection Program to manage loss of material. The staff's evaluation of these programs is documented in SER Sections 3.0.3.1.13 and 3.0.3.1.8, respectively. The staff noted that the applicant states that the one-time inspection of carbon steel and of SS, nickel-alloy, and steel with SS clad RV components exposed to reactor coolant will be by inspection of selected components in areas of stagnant flow and that its selection criteria are consistent with the selection criteria recommended in SRP-LR Section 3.1.2.2.2.1.

On the basis of consistency of the applicant's AMPs and components inspection selection criteria with the recommendations in the SRP-LR, the staff finds the applicant's AMP for these components acceptable.

(2) LRA Section 3.1.2.2.2 states that this SRP-LR Section pertains to BWR isolation condenser components. PNPS has no isolation condenser.

SRP-LR Section 3.1.2.2.2 states that loss of material due to pitting and crevice corrosion may occur in stainless steel BWR isolation condenser components exposed to reactor coolant. Loss of material due to general, pitting, and crevice corrosion may occur in steel BWR isolation condenser components. The existing program controls reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

In the discussion column of LRA Table 3.1.1, item 3.1.1-13, the applicant stated that, although PNPS has no isolation condenser, loss of material in other RCPB steel components is managed by the Water Chemistry Control – BWR Program augmented by the One-Time Inspection Program to verify program effectiveness and that for some components the Inservice Inspection Program is also credited with managing loss of material. The staff's evaluation of these programs is documented in SER Sections 3.0.3.3.3 and 3.0.3.1.8, respectively. The staff noted that the applicant stated that the one-time inspection of carbon steel RV components exposed to reactor coolant will be by inspection of selected components in areas of stagnant flow and that its selection criteria are consistent with the selection criteria recommended in SRP-LR Section 3.1.2.2.2.2.

On the basis that the applicant's AMPs and component inspection selection criteria are consistent with SRP-LR recommendations, the staff finds the applicant's AMP for these components acceptable.

During the audit and review, the staff noted that the AMR result lines in LRA Table 3.1.2-3 that refer to LRA Table 3.1.1, item 3.1.1-13, show the AMPs as Water Chemistry Control – BWR and Inservice Inspection or as only Water Chemistry Control – BWR rather than Water Chemistry Control – BWR Program and One-Time Inspection Program. In the discussion column of LRA Table 3.1.1, item 3.1.1-13, the applicant stated that the One-Time Inspection Program will verify the effectiveness of the Water Chemistry Program. However, line items in LRA Table 3.1.2-3 referring to this Table 3.3.1 line item credit only the Water Chemistry Control – BWR Program. The staff asked the applicant why the One-Time Inspection Program was not credited in the Table 2 line items that refer to this Table 1 line item.

In response, the applicant stated that, because the One-Time Inspection Program applies to each water chemistry control program, it also applies to each line item in Table 2 that credits a water chemistry control program. LRA Table 3.1.1 indicates that the One-Time Inspection Program is credited along with water chemistry control programs for line items where the GALL Report recommends a one-time inspection to confirm water chemistry control. Table 2 credits the One-Time Inspection Program through reference to the corresponding Table 1 line item.

In its response dated July 19, 2006, the applicant stated that the effectiveness of the Water Chemistry Control – Auxiliary Systems, BWR, and Closed Cooling Water Programs is confirmed by the One-Time Inspection Program and revised LRA Appendix A (UFSAR Supplement) for these three water chemistry control programs to include the sentence, "The One-Time Inspection Program will confirm the effectiveness of the program."

On the basis of its review, the staff finds the applicant's response acceptable because the applicant is confirming the effectiveness of the water chemistry by using a one-time inspection.

(3) LRA Section 3.1.2.2.2 addresses the loss of material due to general, pitting, and crevice corrosion in RV SS, nickel-alloy, and steel with SS-clad components and loss of material in RCPB SS (including CASS) components exposed to reactor coolant managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspection of a representative sample of components crediting this program, including areas of stagnant flow. The One-Time Inspection Program also manages loss of material for the MS flow restrictors by a component-specific inspection. For some components, the Inservice Inspection or BWR Vessel Internals Program supplements the Water Chemistry Control – BWR Program.

SRP-LR Section 3.1.2.2.2 states that loss of material due to pitting and crevice corrosion may occur in stainless steel, nickel alloy, and steel with stainless steel or nickel alloy cladding flanges, nozzles, penetrations, pressure housings, safe ends, and vessel shells, heads, and welds exposed to reactor coolant. The existing program controls reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations with stagnant flow conditions; therefore, the effectiveness of water chemistry control programs should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of water chemistry control programs. A One-Time Inspection Program of select components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the component's intended functions will be maintained during the period of extended operation.

In the discussion column of LRA Table 3.1.1, item 3.1.1-15, the applicant stated that loss of material in RCPB SS (including CASS) components is managed by the Water Chemistry Control – BWR Program augmented by the One-Time Inspection Program to verify effectiveness. Additionally, the applicant stated that the One-Time Inspection Program also manages loss of material for the MS line flow restrictors by a component-specific inspection and that for some components the Inservice Inspection Program also manages loss of material. The staff noted that the applicant stated that the one-time inspection of RV carbon steel components exposed to reactor coolant will be by inspection of selected components in areas of stagnant flow and that its selection criteria are consistent with the selection criteria recommended in SRP-LR Section 3.1.2.2.2.3.

On the basis of its review, the staff finds the applicant's AMPs and component inspection selection criteria is consistent with SRP-LR criteria and concludes that the applicant's AMPs for these components acceptable.

(4) LRA Section 3.1.2.2.2 states that this GALL Report paragraph applies only to PWRs. The staff reviewed LRA Section 3.1.2.2.2 against the criteria in SRP-LR Section 3.1.2.2.2 and found this section not applicable because PNPS is a BWR plant.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.2 criteria. For those line items that apply to LRA Section 3.1.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

The staff reviewed LRA Section 3.1.2.2.3 against the following SRP-LR Section 3.1.2.2.3 criteria:

(1) LRA Section 3.1.2.2.3 states that neutron irradiation embrittlement is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.2 documents the staff's review of the applicant's evaluation of this TLAA.

(2) LRA Section 3.1.2.2.3 states that the Reactor Vessel Surveillance Program manages reduction of fracture toughness due to neutron embrittlement of RV beltline materials. The applicant participates in the BWRVIP Integrated Surveillance Program (LRA Appendix B), which monitors changes in the fracture toughness properties of ferritic materials in the RV beltline region.

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.

The staff noted LRA Table 3.1.2-1 shows only the vessel beltline shell (plates and joining welds) as susceptible to the aging effect of reduction in fracture toughness due to neutron irradiation embrittlement; however, the GALL Report also identifies nozzles in the beltline region and safety injection nozzles, which are not BWR vessel components, as susceptible to this aging effect. During the audit and review, the staff reviewed the applicant's AMR documentation for the RPV and noted that the RV beltline consists only of vessel shell plates and joining welds with no nozzles in the beltline region.

On the basis that there are no nozzles in the RV beltline region, the staff determines that the applicant included all components subject to this aging effect consistently with the GALL Report. The staff also reviewed the applicant's Reactor Vessel Surveillance Program (PNPS AMP B.1.26), and evaluation is documented in SER Section 3.0.3.2.15. On the basis of the applicant's inclusion of all components susceptible to this aging effect, the staff finds the applicant's AMR results consistent with the GALL Report and, therefore, acceptable.

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

The staff reviewed LRA Section 3.1.2.2.4 against the following SRP-LR Section 3.1.2.2.4 criteria:

(1) LRA Section 3.1.2.2.4 states that the Water Chemistry Control – BWR Program and One-Time Inspection Program will manage cracking due to SCC and IGSCC in the SS head seal leak detection lines. The One-Time Inspection Program will include a volumetric examination to detect cracking.

SRP-LR Section 3.1.2.2.4 states that cracking due to SCC and IGSCC may occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines. The GALL Report recommends evaluation of a plant-specific AMP because existing programs may not be able to detect or mitigate cracking due to SCC and IGSCC.

The staff noted that LRA Table 3.1.2-3 shows one AMR results line pointing to LRA Table 3.1.1, item 3.1.1-19, SS and nickel alloy top head enclosure vessel flange leak detection line. The AMR result line is for SS piping and fittings less than 4-inches NPS in a reactor coolant environment with an aging effect of cracking and with the AMP as one-time inspection. The staff noted that LRA Table 3.1.1, item 3.1.1-19, states that the Water Chemistry Control – BWR Program and One-Time Inspection Program manage cracking in the SS head seal leak detection lines. On the basis that the GALL Report the recommends Water Chemistry Control-BWR Program with One-Time Inspection Program as appropriate programs to manage this aging effect in similar components of this same material in this same environment, the staff finds the applicant's AMPs for the vessel flange leak detection line acceptable.

(2) LRA Section 3.1.2.2.4 states that this section pertains to BWRs with isolation condenser components. PNPS has no isolation condenser; therefore, this section is not applicable.

On the basis that PNPS has no isolation condenser components, the staff finds this section not applicable to PNPS.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.4 criteria. For those line items that apply to LRA Section 3.1.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.5 Crack Growth Due to Cyclic Loading

LRA Section 3.1.2.2.5 states that this GALL Report paragraph applies only to PWRs. The staff reviewed LRA Section 3.1.2.2.5 against the criteria in SRP-LR Section 3.1.2.2.5 and finds this section not applicable because PNPS is a BWR plant.

3.1.2.2.6 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement and Void Swelling

LRA Section 3.1.2.2.6 states that this GALL Report paragraph applies only to PWRs. The staff reviewed LRA Section 3.1.2.2.6 against the criteria in SRP-LR Section 3.1.2.2.6 and found this section not applicable because PNPS is a BWR plant.

3.1.2.2.7 Cracking Due to Stress Corrosion Cracking

LRA Section 3.1.2.2.7 states that this GALL Report paragraph applies only to PWRs. The staff reviewed LRA Section 3.1.2.2.7 against the criteria in SRP-LR Section 3.1.2.2.7 and found this section not applicable because PNPS is a BWR plant.

3.1.2.2.8 Cracking Due to Cyclic Loading

The staff reviewed LRA Section 3.1.2.2.8 against the following SRP-LR Section 3.1.2.2.8 criteria:

(1) LRA Section 3.1.2.2.8 states that this section pertains to the jet pump sensing lines inside the RV. At PNPS, these lines have no license renewal intended function and thus are not subject to an AMR.

The LRA states that the jet pump instrumentation indicates jet pump flow. As the jet pump flow is not a safety-related function, indication of that flow is not a license renewal function. The lines inside the vessel do not contribute to the pressure boundary. The lines outside the vessel are parts of the RCS pressure boundary and subject to an AMR.

SRP-LR Section 3.1.2.2.8 states that cracking due to cyclic loading may occur in the stainless steel BWR jet pump sensing lines. The GALL Report recommends evaluation of a plant-specific AMP for adequate management of this aging effect.

The staff noted the LRA statements that jet pump flow is not a license renewal function and that the jet pump sensing lines inside the RPV are not parts of the RCPB. On the basis that the jet pump sensing lines have no license renewal function, the staff determines that no AMR for the jet pump sensing lines inside the RPV is required.

During the audit and review, the staff noted the LRA statement that SRP-LR Section 3.1.2.2.8.1 describing cracking due to cyclic loading pertains only to the jet pump sensing lines inside the RV. The staff noted that only the jet pump sensing lines inside the RV are directly in, or in direct contact with, components in the recirculation flow stream; for this reason, only the jet pump sensing lines inside the RV may be affected by flow-induced vibrations and cracking due to cyclic loading caused by flow-induced vibrations.

The applicant stated that the jet pump sensing lines outside the RV are the same as other small-bore SS instrument lines attached to an RV penetration and that they will be subject to the same aging effects and AMPs that apply for small-bore SS piping exposed to reactor coolant. However, they will not be subject to potential cracking due to cyclic loading caused by flow-induced vibrations. The applicant stated that aging management for the jet pump sensing lines outside the RPV will be by the Water Chemistry Control – BWR Program, Inservice Inspection Program, and One-Time Inspection Program as shown in LRA Table 3.1.1, item 3.1.1-48, for small-bore steel and SS Class 1 piping, fittings, and branch connections less than 4-inches NPS exposed to reactor coolant.

The staff reviewed the AMPs and the evaluation is documented in SER Sections 3.0.3.1.13, 3.0.3.3.3, and 3.0.3.1.8, respectively. The staff finds that the aging effects for the jet pump sensing lines outside the reactor coolant pressure vessel are the same as for other small-bore SS piping exposed to reactor coolant, and aging effects are managed by the AMPs as recommended in the GALL Report. On the basis, the staff finds this acceptable.

(2) LRA Section 3.1.2.2.8 states that this section pertains to BWR isolation condenser components. Because PNPS has no isolation condenser, this section is not applicable.

Because PNPS has no isolation condenser components, the staff finds this section not applicable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.8 criteria. For those line items that apply to LRA Section 3.1.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

The staff reviewed LRA Section 3.1.2.2.9 against the criteria in SRP-LR Section 3.1.2.2.9.

LRA Section 3.1.2.2.9 states that loss of preload due to stress relaxation of PWR reactor vessel internal components evaluated under SRP-LR Section 3.1.2.2.9 applies to PWRs only. The staff finds the statement evaluation acceptable because this aging effect does not apply to PNPS, a BWR plant.

3.1.2.2.10 Loss of Material Due to Erosion

The staff reviewed LRA Section 3.1.2.2.10 against the criteria in SRP-LR Section 3.1.2.2.10.

LRA Section 3.1.2.2.10 states that loss of material due to erosion of PWR steam generator components evaluated under SRP-LR Section 3.1.2.2.10 applies to PWRs only. The staff finds the statement acceptable because this aging effect does not apply to PNPS, a BWR plant.

3.1.2.2.11 Cracking Due to Flow-Induced Vibration

The staff reviewed LRA Section 3.1.2.2.11 against the criteria in SRP-LR Section 3.1.2.2.11.

LRA Section 3.1.2.2.11 states that cracking due to flow-induced vibration in the SS steam dryers is managed by the BWRVIP, which incorporates the guidelines of GE-SIL-644, Revision 1. The applicant will evaluate BWRVIP-139 upon approval by the staff and either include its recommendations in the BWRVIP or inform the staff of exceptions to that document.

SRP-LR Section 3.1.2.2.11 states that loss of material due to erosion may occur in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater. The GALL Report recommends further evaluation of a plant-specific AMP for adequate management of this aging effect.

During the audit and review, the staff reviewed BWRVIP-139, "Steam Dryer Inspection and Flaw Evaluation Guidelines," accepted for review by the NRC in June 2005. The staff noted that the applicant's BWRVIP includes inspections of the steam dryer consistent with the guidelines of the original equipment manufacturer. In addition, the LRA states that the applicant will evaluate BWRVIP-139 upon its approval by the staff and either include its recommendations in the BWRVIP or inform the staff of exceptions to that document.

In its response dated October 6, 2006, the applicant stated in Commitment No. 37 that inspections of the steam dryer will follow the guidelines of BWRVIP-139 and GE SIL 644, Revision 1.

On the basis that the applicant's BWRVIP steam dryer inspection is consistent with recommendations of the original equipment manufacturer and that the applicant has committed to these inspections per BWRVIP-139 guidelines, the staff finds the applicant's aging management of the steam dryer acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.11 criteria. For those line items that apply to LRA Section 3.1.2.2.11, 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).

3.1.2.2.12 Cracking Due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.12 against the criteria in SRP-LR Section 3.1.2.2.12.

LRA Section 3.1.2.2.12 states that cracking due to SCC and IASCC of PWR reactor vessel components evaluated under SRP-LR Section 3.1.2.2.12 applies to PWRs only. The staff finds the statement acceptable because this aging effect does not apply to PNPS, a BWR plant.

3.1.2.2.13 Cracking Due to Primary Water Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.13 against the criteria in SRP-LR Section 3.1.2.2.13.

LRA Section 3.1.2.2.13 states that cracking due to primary water SCC of PWR components inside the RV evaluated under SRP-LR Section 3.1.2.2.13 applies to PWRs only. The staff finds the statement acceptable because this aging effect does not apply to PNPS, a BWR plant.

3.1.2.2.14 Wall Thinning Due to Flow-Accelerated Corrosion

The staff reviewed LRA Section 3.1.2.2.14 against the criteria in SRP-LR Section 3.1.2.2.14.

LRA Section 3.1.2.2.14 states that wall thinning due to FAC of PWR steam generator feedwater inlet ring and supports evaluated under SRP-LR Section 3.1.2.2.14 applies to PWRs only. The staff finds the statement acceptable because this aging effect does not apply to PNPS, a BWR plant.

3.1.2.2.15 Changes in Dimensions Due to Void Swelling

The staff reviewed LRA Section 3.1.2.2.15 against the criteria in SRP-LR Section 3.1.2.2.15.

LRA Section 3.1.2.2.15 states that changes in dimensions due to void swelling of PWR reactor vessel internals components evaluated under SRP-LR Section 3.1.2.2.15 applies to PWRs only.

The staff finds the statement acceptable because this aging effect does not apply to PNPS, a BWR plant.

3.1.2.2.16 Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking

LRA Section 3.1.2.2.16 states that this GALL Report paragraph applies only to PWRs. The staff reviewed LRA Section 3.1.2.2.16 against the criteria in SRP-LR Section 3.1.2.2.16 and found this section not applicable because PNPS is a BWR plant.

3.1.2.2.17 Cracking Due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.17 against the criteria in SRP-LR Section 3.1.2.2.17.

LRA Section 3.1.2.2.17 states that cracking due to SCC, primary water SCC, and IASCC of PWR reactor vessel internal components evaluated under SRP-LR Section 3.1.2.2.17 applies to PWRs only. The staff finds the statement acceptable because this aging effect does not apply to PNPS, a BWR plant.

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, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

The staff reviewed LRA Table 3.1.1, *which summarizes aging management evaluations for the* RV, internals, and RCS evaluated in the GALL Report.

LRA Table 3.1.1, item 3.1.1-46 is applicable to mechanical access hole covers. In the discussion column, the applicant states that the access hole covers are welded, not mechanical (bolted). On the basis that PNPS has welded, not mechanical, access hole covers, the staff finds that this AMP summary line in LRA Table 3.1.1 not applicable.

LRA Table 3.1.1, item 3.1.1-53 is applicable to RCS loss of material due to general, pitting, and crevice corrosion of steel piping, piping components, and piping elements exposed to CCW In the discussion column, the applicant stated that in the RCS loss of material due to general, pitting, and crevice corrosion of steel piping, piping components, and piping elements exposed to CCW is not applicable because there are no steel components of the Class 1 RV, reactor internals, or RCPB exposed to CCW.

On *the basis that there are no steel piping, piping components, or piping elements exposed to* CCW in the RV, internals, and RCS the staff finds, for this component type, this aging effect not applicable.

LRA Table 3.1.1, item 3.1.1-54 is applicable to loss of material due to general, pitting, and crevice corrosion of copper alloy piping, piping components, and piping elements exposed to CCW. In the discussion column, the applicant stated that the loss of material due to general, pitting, and crevice corrosion of copper alloy piping, piping components, and piping elements exposed to CCW is not applicable because there are no copper alloy components of the Class 1 RV, vessel internals, or RCPB exposed to CCW.

On the basis that there are no copper alloy piping, piping components, or piping elements exposed to CCW in the RV, internals, and RCS the staff finds, for this component type, this aging effect not applicable.

LRA Table 3.1.1, item 3.1.1-56 is applicable to loss of material due to selective leaching of copper alloy (greater than 15-percent zinc) piping, piping components, and piping elements exposed to CCW. In the discussion column, the applicant stated that the loss of material due to selective leaching of copper alloy (greater than 15-percent zinc) piping, piping components, and piping elements exposed to CCW is not applicable because there are no copper alloy components in the Class 1 RV, vessel internals, or RCPB. On the basis that there are no copper alloy (greater than 15-percent zinc) piping, piping components, and piping elements exposed to CCW in the RV, internals, and RCS the staff finds, for this component type, this aging effect not applicable

LRA Table 3.1.1, item 3.1.1-87 is applicable to the aging of steel piping, piping components, and piping elements in concrete. In the discussion column, the applicant stated that the aging of steel piping, piping components, and piping elements in concrete is not applicable because there are no components of the Class 1 RV, vessel internals, or RCPB exposed to concrete. On the basis that there are no steel piping, piping components, and piping elements in concrete in the RV, internals, and RCS the staff finds, for this component type, this aging effect not applicable.

The staff reviewed LRA Tables 3.1.2.1-1 through 3.1.2.1-3 for RV, internals, and RCS, where no aging effects are shown. Specific areas in which the applicant states that no aging effects were found are the following:

- Components fabricated from low-alloy steel with SS cladding in the containment dome upper closure head, RV flanges, RV shell, and RV nozzles subject to an indoor air environment require no AMR. The environment is not in the GALL Report for this component and material, and the high component surface temperature precludes moisture accumulation that could cause corrosion.

The staff finds that an indoor air environment on low-alloy steel with SS cladding for the containment dome upper closure head, RV flanges, RV shell, and RV nozzles will not cause aging of concern during the period of extended operation. The staff noted that, although the LRA describes the construction material for these components as "steel with stainless steel cladding," the material exposed to the indoor air environment is the low-alloy steel external surface, not the SS cladding. The staff reviewed NUREG-1833, "Technical Basis for Revision to the License Renewal Guidance Documents," and noted that NUREG-1883, Table II.A, item AP-2 / EP-4 / SP-1 applies to piping, piping components, and piping elements of carbon steel in an indoor air environment. The staff noted that NUREG-1883 states that both oxygen and moisture must be present to corrode steel, and experience shows that general corrosion of carbon steel or low-alloy steel components occurs only in components exposed to outdoor environments or to indoor environments that promote water condensation on their external surfaces.

On the basis that the component's high surface temperature during operation precludes accumulation of moisture required for corrosion of low-alloy steel, the staff concludes that there are no applicable AERMs for these low-alloy steel components with SS cladding exposed to an indoor air environment.

- Components fabricated from low-alloy steel in the RV nozzle safe ends and subject to an indoor air environment require no AMR. The environment is not in the GALL Report for this component and material, and the high component surface temperature precludes moisture accumulation that could cause corrosion.

The staff finds that an indoor air environment on low-alloy steel in RV nozzle safe ends will not cause aging of concern during the period of extended operation. The staff noted that NUREG-1833 states that both oxygen and moisture must be present to corrode steel, and experience shows that general corrosion of carbon steel or low-alloy steel components occurs only in components exposed to outdoor environments or to indoor environments that promote the condensation of water on their external surfaces.

On the basis that the component's high surface temperature during operation precludes accumulation of moisture required for corrosion of low-alloy steel, the staff concludes that there are no applicable AERMs for these low-alloy steel components exposed to an indoor air environment.

- Components fabricated from carbon steel in piping and fittings and for valve bodies subject to an indoor air environment require no AMR. The aging effect in the GALL Report for this component, material, and environment combination is not applicable, and the high component surface temperature precludes moisture accumulation that could cause corrosion.

The staff finds that an indoor air environment on carbon steel piping and fittings and valve bodies with a normally hot surface temperature will not cause aging of concern during the period of extended operation. The staff noted that NUREG-1833 states that both oxygen and moisture must be present to corrode steel, and experience shows that general corrosion of carbon steel or low-alloy steel components occurs only in components exposed to outdoor environments or to indoor environments that promote the condensation of water on their external surfaces.

On the basis that the component's high surface temperature during operation precludes accumulation of moisture required for corrosion of carbon steel, the staff concludes that there are no applicable AERMs for carbon steel piping and fitting components exposed to an indoor air environment.

During the audit and review, the staff noted that LRA Table 3.1.2-3 shows some AMR result lines for piping and fittings and for valves made of carbon steel where the external environment is indoor air, the aging effect is loss of material, and the AMP is System Walkdown, referring to LRA Table 3.2.1, item 3.1.2-31. LRA Table 3.1.2-3 shows other AMR result lines for piping and fittings and for valves of carbon steel where the external environment is indoor air but the aging effect is "none" and lists no AMP. The staff also noted that the AMR result lines where the aging effect is "none" note that the components operate at a high surface temperature which precludes moisture accumulation that could cause corrosion. The staff asked the applicant for the high-temperature threshold and the methodology for classifying piping with the aging effect of loss of material and with no aging effect. The applicant made the following response:

> The selection of the aging effect of loss of material or of no aging effect was dependent on the temperature of the component during normal operation. Components with a temperature above the boiling point of water will preclude moisture accumulation. As a matter of convenience, the transition point was assumed at the temperature threshold of 220°F, which corresponds to the temperature threshold for cracking due to fatigue in carbon steel and above the boiling point of water. Although these components can be below this threshold during shutdown conditions, and some components could possibly see temperatures both above and below this threshold during normal operation, these components should rarely, if ever, be at a temperature below the local dewpoint. Consequently, even during shutdown conditions, moisture accumulation should be negligible.
>
> The PNPS position on loss of material on exterior surfaces of steel piping grew out of earlier LRA experience. loss of material on external surfaces is normally managed by system walkdowns; however, system walkdowns do not inspect the exterior surface of insulated piping unless the insulation is removed for maintenance. There is no need to remove insulation and directly inspect pipe external surfaces as the heat that requires the insulation prevents moisture accumulation which, in turn, precludes loss of material due to corrosion. PNPS

plans to inspect uninsulated steel piping for loss of material due to corrosion through system walkdowns and not remove any insulation solely for the purpose of the inspection.

The staff reviewed the applicant's response and finds that it states an acceptable methodology for distinguishing the hot carbon steel pipe (where no aging effect is expected) from the cooler carbon steel pipe (where loss of material due to corrosion may occur). On the basis of the applicant's adequate methodology for selecting which carbon steel piping is subject to examination by the System Walkdown Program the staff finds the applicant's response acceptable.

The staff reviewed all AMR result lines in LRA Tables 3.1.2-1 through 3.1.2-3 determining that for each component there is no aging effect and no AMP required. On the basis of the evaluations documented in the preceding paragraphs, the staff determines that no AMP is required for these components during the period of extended operation.

3.1.2.3.1 Reactor Vessel Summary of Aging Management Evaluation - LRA Table 3.1.2-1

The staff evaluation of LRA Table 3.1.2-1 showing no RV aging effects is in SER Section 3.1.2.3.

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 3.1.2-1, the applicant proposed to manage loss of material of low-alloy steel for the reactor head closure studs exposed to an indoor air environment using "Reactor Head Closure Studs Program."

The staff review of Reactor Head Closure Studs Program is documented in SER Section 3.0.3.2.14. The staff concluded that the applicant's Reactor Head Closure Studs Program will adequately manage the aging effects in the LRA for which this AMP is credited. On the basis of its review, the staff finds the aging effect of loss of material of low-alloy steel material exposed to an indoor air environment is managed effectively by the Reactor Head Closure Studs Program. On this basis, the staff finds that management of loss of material for the reactor head closure studs in LRA Table 3.1.2-1, "Reactor Vessel – Summary of Aging Management Evaluation," is acceptable.

In LRA Table 3.1.2-1, the applicant proposed to manage cracking of low-alloy steel with SS or partial SS cladding for the RV upper head and bottom head, vessel flanges, vessel shells, and MS line nozzles exposed to reactor coolant environment using LRA AMP B.1.16.2, "Inservice Inspection Program," and AMP B.1.32.2, "Water Chemistry Control – BWR Program."

The staff review of Inservice Inspection Program and the Water Chemistry Control – BWR Program, is documented in SER Sections 3.0.3.3.3 and 3.0.3.1.13, respectively. The staff concludes that the applicant's Inservice Inspection and Water Chemistry Control – BWR Programs will adequately manage the aging effects in the LRA for which these AMPs are credited. Based on its review, the staff finds the aging effect of cracking of low-alloy steel with SS or partial SS clad material exposed to a reactor coolant environment is managed effectively by the Inservice Inspection and Water Chemistry Control – BWR Programs. On this basis, the staff finds that management of cracking for the RV upper head and bottom head, vessel flanges, vessel shells, and MS line nozzles in LRA Table 3.1.2-1, "Reactor Vessel – Summary of Aging Management Evaluation," is acceptable.

In LRA Table 3.1.2-1, the applicant proposed to manage cracking of nickel-based alloy for the CRD return line nozzle cap exposed to a reactor coolant environment using AMP B.1.3, "BWR Control Rod Drive Return Line Nozzle Program," and AMP B.1.32.2, "Water Chemistry Control – BWR Program."

The staff review of BWR Control Rod Drive Return Line Nozzle Program and the Water Chemistry Control – BWR Program is documented in SER Sections 3.0.3.2.2 and 3.0.3.1.13, respectively.

GALL AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle," recommends that enhanced inspection requirements specified in the NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," should manage cracking in the CRD return line nozzle weld.

The applicant stated that it will manage this aging effect by implementing AMP B.1.3, "BWR CRD Return Line Nozzle," which complies with GALL AMP XI.M6 with exceptions approved by the staff. The staff's review of BWR Return Line Nozzle Program is in SER Section 3.0.3.2.2. GALL AMP XI.M6 requires application of ASME Code Section XI, 2001 Edition and 2002 and 2003 Addenda, Subsection IWB 2500-1 inspection requirements and of the NUREG-0619 requirements to monitor this aging effect. The applicant cut and capped the CRD return line nozzle to mitigate cracking and continues ASME Code Section XI ISI examinations to monitor the effects of crack initiation and growth on the intended function of the CRD return line nozzle-to-cap weld. In 2003, a structural weld overlay was installed over a through-wall crack in the CRD return line nozzle-to-cap weld. Nickel-Alloy (Inconel 52) weld metal in the overlay improved its resistence to IGSCC. The staff, in its letter dated February 25, 2005, approved the structural overlay on the CRD return line nozzle-to-cap weld.

In RAI B.1.3-1 dated July 31, 2006,the staff requested that the applicant provide information on inspection type and frequency for the capped CRD return line nozzle weld overlay during the period of extended operation.

In its response dated August 30, 2006, the applicant stated that it will continue to inspect the subject weld overlay as a Category E weld in accordance with BWRVIP-75-A report, "Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules," during the period of extended operation. In a conference call with the staff on October 10, 2006, the applicant confirmed that the subject weld overlay, consistent with AMP B.1.3, will be inspected in accordance with the BWRVIP-75 report guidelines.

Based on its review, the staff finds the applicant's response to RAI B.1.3-1 acceptable because the inspection methodology and inspection frequency specified in the staff-approved BWRVIP-75 report would detect aging degradation adequately and promptly. The staff's concern described in RAI B.1.3-1 is resolved.

In RAI B.1.3-2 dated July 31, 2006, the staff requested that the applicant provide justification for Exception 1 to GALL AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle." The applicant proposed to use ASME Code Case N-613-1, "Ultrasonic Examination of Full Penetration Nozzles, in Vessels, Examination Category B-D Item Numbers B 3.10 and B 3.90, Reactor

Vessel-To-Nozzle Welds, Figure IWB-2500-7(a), (b), and (c) Section XI, Division 1." ASME Code Section XI, Figures IWB-2500-7(a), (b), and (c) state that a minimum volume of base material on each side of the weld equal to a distance of ½ t (the vessel shell thickness) shall be examined. ASME Code Case N-613-1 allows a reduction in the examination volume from ½ t to a value of ½ inch next to the widest part of the "N" 10 nozzle-to-vessel weld.

In its response dated August 30, 2006, the applicant stated that ASME Code Case N-613-1 was accepted by the staff and included in RG 1.147, Revision 14, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." Furthermore, in its response dated September 13, 2006, the applicant deleted Exception 1 to GALL AMP XI.M6 from LRA AMP B.1.3, "BWR Control Rod Drive Return Line Nozzle," because the reduction of examination volume of the subject weld is now in accordance with a staff-approved code case.

The staff had accepted this code case and, therefore, the applicant can apply this exception in the LRA. As GALL AMP XI.M6 does not endorse ASME Code Case N-613-1, the applicant's proposed technical basis for deleting exception 1 to GALL AMP XI.M6 in the LRA is not valid. The staff determines that this exception to GALL AMP XI.M6 is technically acceptable; therefore, the applicant should reinstate this exception in the LRA AMP B.1.3. In a conference call December 12, 2006, the applicant agreed to reinstate Exception 1 in the LRA AMP B.1.3 in the next annual update.

In its response dated January 16, 2007, the applicant stated that this exception need not be deleted and will be reinstated; therefore, the staff's concern described in RAI B.1.3-2 is resolved.

As to the applicant's evaluation of the embedded flaw growth in the structural weld overlay on the CRD return line nozzle-to-cap weld, the staff determined that there should be an evaluation under 10 CFR 54.21 and TLAA criteria. The staff's review of this TLAA is in SER Section 4.1.2.1.

The staff concludes that the applicant's BWR Control Rod Drive Return Line Nozzle Program, with the staff-approved exceptions, ASME Code Section XI ISI Program, and Water Chemistry Control – BWR Program will adequately manage the aging effects in the LRA for which these AMPs are credited. On the basis of its review, the staff finds the aging effect of cracking of nickel-based alloy material exposed to a reactor coolant environment is managed effectively by the BWR Control Rod Drive Return Line Nozzle and Water Chemistry Control – BWR programs. On this basis, the staff finds that management of cracking for the CRD return line nozzle cap in LRA Table 3.1.2-1, "Reactor Vessel – Summary of Aging Management Evaluation," is acceptable.

In LRA Table 3.1.2-1, the applicant proposed to manage loss of material of carbon steel for the RV stabilizer pads and the RV support skirt exposed to an indoor air environment using PNPS AMP B.1.16.2, "Inservice Inspection Program."

During the audit and review, the staff asked the applicant for the mechanism that causes the aging effect of loss of material in the stabilizer pads. In response the applicant stated that the stabilizer pads located on the RV sides are typically at a temperature greater than 220°F and that, as with other carbon steel components in indoor environments operating at greater than 220°F, these components should not be subject to loss of material.

In its response dated September 13, 2006, the applicant revised the LRA to indicate that the aging effect applies to the RV support skirt but not to the RV stabilizer pads. Because the applicant's change shows the aging effect for carbon steel RV stabilizer pads in an indoor air environment the same as for other components of the same material, in the same environment, and with a normal operating temperature greater than 220°F, the staff finds the applicant's change acceptable.

The staff review of the Inservice Inspection Program is documented in SER Section 3.0.3.3.3. The staff concludes that the applicant's Inservice Inspection Program will adequately manage the aging effects in the LRA for which this AMP is credited. Based on its review of the applicant's plant-specific and industry operating experience, the staff finds the aging effect of loss of material of carbon steel material exposed to an indoor air environment is managed effectively by the Inservice Inspection Program. On this basis, the staff finds that management of loss of material for the RV support skirt in PNPS LRA Table 3.1.2-1, "Reactor Vessel – Summary of Aging Management Evaluation," is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.2 Reactor Vessel Internals Summary of Aging Management Evaluation - LRA Table 3.1.2-2

The staff evaluation of LRA Table 3.1.2-2 showing no aging effects for reactor vessel internals is in SER Section 3.1.2.3.

The staff reviewed LRA Table 3.1.2-2, which summarizes the results of AMR evaluations for the reactor vessel internals component groups.

In LRA Table 3.1.2-2, the applicant proposed to manage cracking of the stainless steel core plate assembly rim bolts using AMP B.1.8 (3.0.3.2.7), "BWR Vessel Internals BWR Control Rod Drive Return Line Nozzle Program," and AMP B.1.32.2 (3.0.3.1.13), "Water Chemistry Control – BWR Program."

The staff reviewed the Water Chemistry Control – BWR Program and finds that it controls RCS water chemistry adequately. BWR Vessel Internals BWR Control Rod Drive Return Line Nozzle Program in effect invokes the inspection requirements of the ASME Code, Section XI ISI Program which mandates implementation of periodic inspections and inspection methods for certain RVI components. In addition, the core plate assembly rim bolts are inspected per the BWRVIP-25 Report, "BWR Core Plate Inspection and Flaw Evaluation Guidelines," which requires frequent inspections complementary to the ASME Code ISI. The staff concludes that the applicant's BWR Vessel Internals BWR Control Rod Drive Return Line Nozzle Program and Water Chemistry Control – BWR Program would be consistent with the GALL AMPs XI.M9 and XI.M2. On this basis, the staff finds that management of cracking for the RV upper head and bottom head, vessel flanges, vessel shells, and MS line nozzles in LRA Table 3.1.2-1, "Reactor Vessel – Summary of Aging Management Evaluation," is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL

Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.3 Reactor Coolant Pressure Boundary Summary of Aging Management Evaluation - LRA Table 3.1.2-3

The staff evaluation of LRA Table 3.1.2-3 showing no aging effects for RCS is in SER Section 3.1.2.3.

The staff reviewed LRA Table 3.1.2-3, which summarizes the results of AMR evaluations for the reactor coolant pressure boundary component groups.

In LRA Table 3.1.2-3, the applicant proposed to manage cracking of low-alloy steel or SS for RCPB bolting exposed to an indoor air environment using the Inservice Inspection Program.

Originally, the applicant did not include a Bolting Integrity Program in the LRA. Instead, the applicant credited alternates like the System Walkdown Program and Inservice Inspection Program. GALL AMP XI.M18, "Bolting Integrity," makes several recommendations in the 10-element evaluation (*e.g.*, selection of bolting materials, use of lubricants and sealants, and additional NUREG-1339 recommendations). The alternate programs may be acceptable for inspection; however, they do not address preventive actions. The staff asked the applicant, during the audit and review, to clarify how PNPS meets these recommendations or justify why there should be no Bolting Integrity Program.

In its response to the audit and review questions, the applicant stated that the Bolting Integrity Program will be developed to address bolting aging management within the scope of license renewal and a copy of the AMP basis will be provided for review. The Bolting Integrity Program will be implemented before the period of extended operation in accordance with Commitment No. 32. The LRA will be supplemented to describe the Bolting Integrity Program in Appendices A and B and to show where the program applies.

In its response dated September 13, 2006, the applicant included the Bolting Integrity Program. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," and covers bolting within the scope of license renewal, including (1) safety-related bolting, (2) bolting for nuclear steam supply system component supports, (3) bolting for other pressure-retaining components, including nonsafety-related bolting, and (4) structural bolting (actual measured yield strength greater than150 ksi). The aging management of reactor head closure studs addressed by GALL AMP XI.M3 is not included in this program. Therefore, the aging effects of component type of bolting in all mechanical systems, except reactor head closure studs, are managed by the Bolting Integrity Program instead of any other programs in LRA Table 3.3.2-2 items.

The evaluation of this program is documented in SER Section 3.0.3.2.20. The staff reviewed the program and finds it acceptable.

On the basis of its review of the applicant's operating experience, the staff finds the aging effect of cracking of low-alloy steel or SS material exposed to an indoor air environment is managed effectively by the Bolting Integrity Program. On this basis, the staff finds that management of cracking of bolting in LRA Table 3.1.2-3, "Reactor Coolant Pressure Boundary – Summary of Aging Management Evaluation," is acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3 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 reactor coolant system components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2 <u>Aging Management of Engineered Safety Features System</u>

This section of the SER documents the staff's review of the applicant's AMR results for the engineered safety features (ESF) system components and component groups of the following:

- residual heat removal (RHR) system
- core spray system
- automatic depressurization system (ADS)
- high pressure coolant injection (HPCI) system
- RCIC system
- SGT system
- primary containment penetrations
- miscellaneous systems in-scope for 10 CFR 54.4(a)(2) (These ESF systems are included in LRA Section 3.3, "Auxiliary Systems," but are evaluated in this section.)
- core spray system, nonsafety-related components affecting safety-related systems
- HPCI system, nonsafety-related components affecting safety-related systems
- RCIC system, nonsafety-related components affecting safety-related systems
- RHR system, nonsafety-related components affecting safety-related systems

3.2.1 Summary of Technical Information in the Application

LRA Section 3.2 provides AMR results for the ESF system components and component groups. LRA Table 3.2.1, "Summary of Aging Management Evaluations for the Engineered Safety Features," is a summary comparison of the applicant's AMRs with the AMRs evaluated in the GALL Report for the ESF system components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effects requiring management (AERM). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of CRs and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.2.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the ESF system components that are 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 confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL 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 Audit and Review Report Section 3.2.2.1 and are summarized 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 acceptance criteria in SRP-LR Section 3.2.2.2. The staff's audit evaluations are documented in Audit and Review Report Section 3.2.2.2 and are summarized in SER Section 3.2.2.2.

During the onsite audit, the staff also conducted a technical review of the remaining AMRs that were not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in Audit and Review Report Section 3.2.2.3 and are summarized in SER Section 3.2.2.3. The staff's evaluation of the technical review is also documented in SER Section 3.2.2.3.

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 ESF system components.

Table 3.2-1, provided below, includes a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs, listed in LRA Section 3.2, that are addressed in the GALL Report.

Table 3.2-1 Staff Evaluation for Engineered Safety Features System Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel and SS piping, piping components, and piping elements in emergency core cooling system (ECCS) (3.2.1-1)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.1)
Steel with SS cladding pump casing exposed to treated borated water (3.2.1-2)	Loss of material due to cladding breach	A plant-specific AMP is to be evaluated. Reference NRC IN 94-63,"Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks"	N/A	Not applicable to BWRs
SS 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	Water Chemistry (B.1.32) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.3)
SS piping, piping components, and piping elements exposed to soil (3.2.1-4)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	None	Not applicable (See SER Section 3.2.2.2.3)
SS 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	Water Chemistry (B.1.32) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.3)
SS 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	Oil Analysis Program (B.1.22)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Partially encased SS tanks with breached moisture barrier exposed to raw water (3.2.1-7)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated for pitting and crevice corrosion of tank bottoms because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	None	Not applicable (See SER Section 3.2.2.2.3)
SS piping, piping components, piping elements, and tank internal surfaces exposed to condensation (internal) (3.2.1-8)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	None	Not applicable (See SER Section 3.2.2.2.3)
Steel, SS, 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	Oil Analysis Program (B.1.22)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.4)
SS heat exchanger tubes exposed to treated water (3.2.1-10)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Water Chemistry (B.1.32) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.4)
Elastomer seals and components in SGT system exposed to air - indoor uncontrolled (3.2.1-11)	Hardening and loss of strength due to elastomer degradation.	A plant-specific AMP is to be evaluated.	Plant-specific Periodic Surveillance and Preventative Maintenance Program (B.1.24)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.5)
SS 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 AMP is to be evaluated for erosion of the orifice due to extended use of the centrifugal HPSI pump for normal charging.	N/A	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	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 AMP is to be evaluated.	None	Not applicable (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	Water Chemistry (B.1.32) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (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	None	Not applicable (See SER Section 3.2.2.2.8)
Steel piping, piping components, and piping elements exposed to lubricating oil (3.2.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Oil Analysis Program (B.1.22)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.8)
Steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil (3.2.1-17)	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	Buried Piping and Tanks Inspection Program (B.1.2)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.2.2.2.9)
SS piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.2.1-18)	Cracking due to SCC and IGSCC	BWR Stress Corrosion Cracking and Water Chemistry	Water Chemistry Control - BWR (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel piping, piping components, and piping elements exposed to steam or treated water (3.2.1-19)	Wall thinning due to FAC	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion Program (B.1.14) or Periodic Surveillance and Preventative Maintenance Program (B.1.2.4)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
Cast austenitic SS 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	None	Not applicable (See SER Section 3.2.2.3)
High-strength steel closure bolting exposed to air with steam or water leakage (3.2.1-21)	Cracking due to cyclic loading, SSC	Bolting Integrity	None	Not applicable (See SER Section 3.2.2.3)
Steel closure bolting exposed to air with steam or water leakage (3.2.1-22)	Loss of material due to general corrosion	Bolting Integrity	Bolting Integrity	(Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
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	Bolting Integrity	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
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	Bolting Integrity	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
SS piping, piping components, and piping elements exposed to closed cycle cooling water > 60°C (> 140°F) (3.2.1-25)	Cracking due to SSC	Closed-Cycle Cooling Water System	Water Chemistry Control-Closed Cooling Water Program (B.1.32.3)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	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	None	Not applicable (See SER Section 3.2.2.3)
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	Water Chemistry Control-Closed Cooling Water Program (B.1.32.3)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
SS 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	Water Chemistry Control-Closed Cooling Water Program (B.1.32.3)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
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	Water Chemistry Control-Closed Cooling Water Program (B.1.32.3)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
SS 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	Water Chemistry Control-Closed Cooling Water Program (B.1.32.3)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
External surfaces of steel components including ducting, piping, ducting closure bolting, and containment isolation piping external surfaces exposed to air - indoor uncontrolled (external); condensation (external) and air - outdoor (external) (3.2.1-31)	Loss of material due to general corrosion	External Surfaces Monitoring	System Walkdown Program (B.1.30)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	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	System Walkdown Program (B.1.30), Periodic Surveillance and Preventative Maintenance Program (B.1.24), One-Time Inspection Program (B.1.23)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
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	None	Not applicable (See SER Section 3.2.2.1)
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	Periodic Surveillance and Preventative Maintenance Program (B.1.24)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
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	Periodic Surveillance and Preventative Maintenance Program (B.1.24) and Containment Leak Rate Program (B.1.9)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
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	None	Not applicable (See SER Section 3.2.2.3)
SS 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	None	Not applicable (See SER Section 3.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS 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	None	Not applicable (See SER Section 3.2.2.3)
SS 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	None	Not applicable (See SER Section 3.2.2.3)
Steel and SS 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	None	Not applicable (See SER Section 3.2.2.3)
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	Selective Leaching Program (B.1.27)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)
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	None	Not applicable (See SER Section 3.2.2.3)
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	None	Not applicable (See SER Section 3.2.2.3)
Gray cast iron motor cooler exposed to treated water (3.2.1-44)	Loss of material due to selective leaching	Selective Leaching of Materials	Selective Leaching Program (B.1.27)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	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	N/A	Not applicable to BWRs
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	N/A	Not applicable to BWRs
Cast austenitic SS 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	N/A	Not applicable to BWRs
SS 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 SCC	Water Chemistry	N/A	Not applicable to BWRs
SS 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	N/A	Not applicable to BWRs
Aluminum piping, piping components, and piping elements exposed to air - indoor uncontrolled (internal/external) (3.2.1-50)	None	None	None	Not applicable (See SER Section 3.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Galvanized steel ducting exposed to air - indoor controlled (external) (3.2.1-51)	None	None	None	Not applicable (See SER Section 3.2.2.3)
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	None	Not applicable (See SER Section 3.2.2.3)
SS, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.2.1-53)	None	None	None	Not applicable (See SER Section 3.2.2.3)
Steel piping, piping components, and piping elements exposed to air - indoor controlled (external) (3.2.1-54)	None	None	None	Not applicable (See SER Section 3.2.2.3)
Steel and SS piping, piping components, and piping elements in concrete (3.2.1-55)	None	None	None	Not applicable (See SER Section 3.2.2.3)
Steel, SS, and copper alloy piping, piping components, and piping elements exposed to gas (3.2.1-56)	None	None	None	Not applicable (See SER Section 3.2.2.3)
SS and copper alloy < 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.2.1-57)	None	None	N/A	Not applicable to BWRs

The staff's review of the engineered safety features system 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 engineered safety features system 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, and AERMs and the following programs that manage aging effects for the engineered safety features system components:

- Buried Piping and Tanks Inspection Program
- Containment Leak Rate Program
- Flow-Accelerated Corrosion Program
- Heat Exchanger Monitoring Program
- Instrument Air Quality Program
- Oil Analysis Program
- One-Time Inspection Program
- Periodic Surveillance and Preventive Maintenance Program
- Selective Leaching Program
- System Walkdown Program
- Water Chemistry Control - BWR Program
- Water Chemistry Control - Closed Cooling Water Program

LRA Tables 3.2.2-1 through 3.2.2-7 summarize AMRs for the engineered safety features system components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency 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 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

AMP. The staff audited these line items to verify consistency with the GALL Report and verified that the identified exceptions to the GALL AMPs have been reviewed and accepted. The staff also determines whether the applicant's AMP was consistent with the GALL 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 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 determines 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 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 AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL 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 determines whether the credited AMP would manage the aging effect consistently with the GALL AMP and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in Audit and Review Report Section 3.2.2.1. 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 AMRs. The staff's evaluation is discussed below.

3.2.2.1.1 Loss of Material Due to General Corrosion

The discussion column of LRA Table 3.2.1, item 3.2.1-32 states that loss of material due to general corrosion in steel piping and ducting components and internal surfaces exposed to air-indoor uncontrolled (internal) for engineered safety feature (ESF) systems is managed by the One-Time Inspection, System Walkdown, and the Periodic Surveillance and Preventive Maintenance programs. During the audit and review, the staff noted that 14 AMR result lines pointing to Table 3.2.1, item 3.2.1-32, refer to Note E. The lines that refer to Note E summarize AMR results for internal surfaces in miscellaneous piping and ducting components of the RHR, automatic depressurization system (ADS), SGT, and primary containment penetrations system.

The staff reviewed the AMR result lines referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL

Report; however, where the GALL Report recommends GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program," the applicant proposed the One-Time Inspection, System Walkdown, and Periodic Surveillance and Preventive Maintenance programs. The staff noted that the System Walkdown Program (B.1.30), Periodic Surveillance and Preventive Maintenance Program (B.1.24), and One-Time Inspection Program (B.1.23) all provide for visual or NDE inspection of external surfaces of these components. In addition, the staff noted that GALL AMP XI.M36, "External Surfaces Monitoring," states in the fourth paragraph of Element 1, "Scope of Program," that this AMP also may be credited with managing loss of material from internal surfaces for situations in which material and environmental combinations are the same for internal and external surfaces. As these components are all exposed to the same environment on the inside and the outside (air-indoor uncontrolled), the Periodic Surveillance and Preventive Maintenance Program, the System Walkdown Program, and the One-Time Inspection Program inspect representative samples of external and internal surfaces by visual or NDE techniques consistent with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program."

On this basis, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program, the System Walkdown Program, and the One-Time Inspection Program for aging management of the internal and external surfaces in miscellaneous piping and ducting components of the RHR, ADS, SGT, and primary containment penetrations system acceptable. The staff's evaluation of these programs is documented in SER Sections 3.0.3.3.5, 3.0.3.1.11, and 3.0.3.1.8, respectively. On the basis of its review, the staff found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.2.2.1.2 Loss of Material Due to General Corrosion, Pitting, and Crevice Corrosion

The discussion column of LRA Table 3.2.1, item 3.2.1-34 states that loss of material due to general corrosion, pitting, and crevice corrosion in steel piping, piping components, and piping elements exposed to condensation (internal) for ESF systems is managed with the Periodic Surveillance and Preventive Maintenance Program (B.1.24). During the audit and review, the staff noted that two AMR result lines pointing to Table 3.2.1, item 3.2.1-34 refer to Note E. The lines that refer to Note E summarize AMR results for piping and blower housing of the HPCI system.

The staff reviewed the AMR result lines referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," the applicant proposed the Periodic Surveillance and Preventive Maintenance Program. The staff noted that the Periodic Surveillance and Preventive Maintenance Program (B.1.24) provides for visual or NDE inspection of external surfaces of these components and that the GALL AMP XI.M36, "External Surfaces Monitoring," states in the fourth paragraph of Element 1, "scope of program," that this AMP also may be credited with managing loss of material from internal surfaces for situations in which material and environmental combinations are the same for internal and external surfaces. As these components are exposed to the same environment on the inside and the outside, the Periodic Surveillance and Preventive Maintenance Program inspects external and internal surfaces by visual or NDE techniques consistent with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program."

On this basis, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program for aging management of the HPCI system piping and blower housing acceptable. On the basis of its review, the staff found that the applicant addressed the AEM appropriately, as recommended by the GALL Report.

3.2.2.1.3 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

The discussion column of LRA Table 3.2.1, item 3.2.1.35 states that loss of material in steel containment isolation piping and components internal surfaces exposed to raw water is managed with the Periodic Surveillance and Preventive Maintenance Program (B.1.24) and the Containment Leak Rate Program (B.1.9). The GALL Report recommends managing these components with GALL AMP XI.M20, "Open-Cycle Cooling Water System Program."

During the audit and review, the staff noted that the plant-specific program provides for visual and/or UT inspection, as in GALL AMP XI.M20, but not for preventive actions. The applicant was asked what preventive actions manage loss of material due to general, pitting, crevice, and MIC and fouling. The applicant's response was that the environment for these components is not strictly raw water, but is untreated water in containment drain lines. The raw water environment was selected because no other environment specified in the GALL Report was a better match. Additionally, these components are not part of the raw water cooling system and, therefore, the GL 88-13 preventive action requirements do not apply. GL 88-13 is the primary basis for the GALL AMP XI.M20, "Open-Cycle Cooling Water System Program." The staff noted that for four AMR result lines pointing to Table 3.2.1, item 3.2.1-35 refer to Note E. Two lines that refer to Note E summarize AMR results for which the AMP is the Periodic Surveillance and Preventive Maintenance Program (B.1.24). The staff determined that the Periodic Surveillance and Preventive Maintenance Program (B.1.24) inspections will manage aging. Based on this determination, the staff found the applicant's use of Note E appropriate and these AMR results for these two lines acceptable.

Two lines that refer to Note E summarize AMR results for which the AMP is the Containment Leak Rate Program (B.1.9). The staff noted that the Containment Leak Rate Program (B.1.9) is in accordance with GALL AMP XI.S4, "10 CFR 50, Appendix J." This program does not detect initiation of aging. During the audit and review, the staff asked the applicant to justify use of the Containment Leak Rate Program alone to manage the aging effects. In response to this request, the applicant stated that the Periodic Surveillance and Preventive Maintenance Program is more appropriate to manage loss of material for piping and valve bodies in a raw water internal environment. Therefore, the applicant committed to revise the LRA to credit the Periodic Surveillance and Preventive Maintenance Program to manage the aging effects instead of the Containment Leak Rate Program. Additionally, the applicant committed to revise LRA item 3.2.1-35 of Table 3.2.1 to state that the Periodic and Preventive Maintenance Program manages the loss of material for steel components exposed to raw water.

In a letter dated July 19, 2006, the applicant revised LRA Table 3.2.2-7 line items with components piping and valve body exposed to raw water (internal) managed by the Containment

Leak Rate Program to credit the Periodic Surveillance and Preventive Maintenance Program for management of aging effects. LRA Table 3.2.1, item 3.2.1-35 discussion is revised as follows:

> The Periodic Surveillance and Preventive Maintenance Program manages loss of material for steel components exposed to raw water.
>
> LRA Section B.1.24 Program Description is revised to specify program activities for primary containment penetrations including visual or other NDE techniques to inspect internal surfaces of carbon steel penetration components.

The staff reviewed the Periodic Surveillance and Preventive Maintenance Program (B.1.24) and its evaluation is documented in SER Section 3.0.3.3.5. Based on this review, the staff found the applicant's use of Note E appropriate and these AMR results acceptable.

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 found that the applicant appropriately addressed the AEM as recommended by the GALL Report.

3.2.2.1.4 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion and Cracking Due to SCC Where PNPS Has Credited the Water Chemistry Program with the One-Time Inspection Program as the Verification Program

The discussion column of LRA Table 3.2.1, items 3.2.1-3, 3.2.1-5, 3.2.1-10, 3.2.1-14, and 3.2.1-18 states that the One-Time Inspection Program will verify the effectiveness of the Water Chemistry Program. However, for Table 3.2.2-X line items referring to these Table 3.2.1 line items, only the Water Chemistry Control – BWR Program is credited. During the audit and review, the staff asked the applicant why the One-Time Inspection Program was not credited in the Table 2 line items that refer to these Table 1 line items.

In response, the applicant stated that, because the One-Time Inspection Program applies to each water chemistry control program, it also applies to each Table 2 line item that credits a water chemistry control program. LRA Table 3.2.1 credits the One-Time Inspection Program along with the water chemistry control programs for line items where the GALL Report recommends a one-time inspection to confirm water chemistry control. Table 3.2.2-X credits the One-Time Inspection Program through reference to the corresponding Table 1 line item. The applicant further stated that the water chemistry control programs in LRA Appendices A and B will be revised to indicate clearly that the One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program.

In a letter dated July 19, 2006, the applicant stated that the effectiveness of the Water Chemistry Control – Auxiliary Systems, BWR, and Closed Cooling Water programs is confirmed by the One-Time Inspection Program. For further clarification, the applicant revised LRA Appendix A for these three water chemistry control programs to include the sentence "The One-Time Inspection Program will confirm the effectiveness of the program."

On the basis of its review, the staff finds the applicant's response acceptable because the applicant is confirming the effectiveness of the Water Chemistry Control – Auxiliary Systems, BWR and Closed Cooling Water programs with the One-Time Inspection Program.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.2.2.1.5 Loss of Material, Loss of Preload, and Cracking of Carbon Steel and SS Bolting in Various External Environments

Originally, the applicant did not include a Bolting Integrity Program in the LRA. Instead, the applicant credited alternate programs like the System Walkdown, Service Water Integrity, and Buried Piping and Tanks Inspection programs for assessing bolting. GALL AMP XI.M18, "Bolting Integrity," makes several recommendations in the 10-element evaluation (*e.g.*, selection of bolting materials, use of lubricants and sealants, and additional NUREG-1339 recommendations). The alternate programs may be acceptable for inspection; however, they do not address preventive actions. This fact applies to Table 3.2.1, items 22, 23, and 24. The staff asked the applicant to clarify how it meets these recommendations or justify why there should be no bolting program.

In a letter dated July 19, 2006, the applicant included "Bolting Integrity Program." This program is consistent with GALL AMP XI.M18, "Bolting Integrity," and covers bolting within the scope of license renewal, including (1) safety-related bolting, (2) bolting for nuclear steam supply system component supports, (3) bolting for other pressure-retaining components, including nonsafety-related bolting, and (4) structural bolting (actual measured yield strength greater than 150 ksi). The aging management of reactor head closure studs is addressed by GALL AMP XI.M3 and not included in this program. Therefore, the aging effects of component type of bolting in all mechanical systems, except reactor head closure studs, are managed by the Bolting Integrity Program instead of any other programs in the LRA Table 3.3.2-2 items. The evaluation of this program is documented in SER Section 3.0.3.2.20. The staff reviewed the program and found it acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.2.2.1.6 Loss of Material Due to Pitting and Crevice Corrosion of Copper Alloy Fire Protection Piping, Piping Components, and Piping Elements Exposed to Condensation (Internal)

During the audit and review, the staff noted that some AMR result lines for the SGT system pointed to Section 3.3, "Auxiliary Systems," Table 3.3.1, item 3.3.1-28. These line items refer to Note E. This line item, applicable to copper alloy components with internal surfaces exposed to a treated air environment, was referenced on two component types: tubing and valve body.

The staff reviewed the AMR result lines that reference to Note E and determined that the component type, material, environment, and aging effects are consistent with those of the corresponding lines of the GALL Report. The GALL Report recommends evaluation of a plant-specific AMP. LRA Table 3.3.1, item 3.3.1-28 specifies the Periodic Surveillance and Preventive Maintenance Program, One-Time Inspection Program, and Instrument Air Quality Program to manage loss of material in copper alloys. However, the AMR line items specify only the Instrument Air Quality Program to manage loss of material. The staff noted that the

Instrument Air Quality Program only monitors air quality and requires testing for leakage rates, inspection for corrosion, and component performance testing as recommended by GALL AMP XI.M24, "Compressed Air Monitoring Program." The staff asked the applicant during the review and audit to implement additional programs with inspection of and functional and leakage testing for these components, or justify not requiring these activities. In its response, the applicant stated that performance monitoring under the Maintenance Rule addresses active components included in performance testing. Recent internal inspections of the air receiver tanks and moisture checks of the IA system have not detected significant corrosion or moisture in the system. The applicant stated that these past inspections confirm the effectiveness of the Instrument Air Quality Program in managing the aging effects of components exposed to IA without the additional program attributes recommended by GALL AMP XI.M24. Additionally, there were no aging effects for components exposed to IA requiring additional management.

The staff determined that past inspections do not confirm the effectiveness of the Instrument Air Quality Program in managing the aging effects. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of degradation.

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 found that the applicant addressed the AEM adequately as recommended by the GALL Report.

3.2.2.1.7 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking, SS Piping, Piping Components, and Piping Elements Exposed to Treated Water Greater Than 140°F

The discussion column of LRA Table 3.2.1, item 3.2.1-18 states that the Water Chemistry Control – BWR Program manages cracking of SS components. None of the ESF system components is subject to the BWR Stress Corrosion Cracking Program (all relevant components are included in the RV, internals, and RCS). The One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program. During the audit and review, the staff noted that LRA Table 3.2.1, item 3.2.1-18 states that none of the ESF system components is within the BWR Stress Corrosion Cracking Program. The staff requested the applicant for the details that justify this statement.

In a letter dated October 6, 2006, the applicant responded that, as stated in LRA Section B.1.6, the BWR Stress Corrosion Cracking Program applies to RCPB components of SS or CASS. As described in LRA Section 2.3.1.3, ESF system component parts of the RCPB (Class 1) are included in the RCPB AMR in Table 3.1.2-3. On this basis the staff concludes that none of the ESF system components in Section 3.2 Tables are within the BWR Stress Corrosion Cracking Program.

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 found that the applicant addressed the AEM adequately as recommended by the GALL Report.

3.2.2.1.8 Wall Thinning Due to Flow-Accelerated Corrosion of Steel Piping, Piping Components, and Piping Elements Exposed to Steam or Treated Water

The discussion column of LRA Table 3.2.1, item 3.2.1-19 states that, consistent with the GALL Report for steel piping exposed to steam in the HPCI system, the Flow-Accelerated Corrosion Program manages wall thinning in steel piping. For steel piping exposed to steam in the RCIC system, loss of material is managed by the Periodic Surveillance and Preventive Maintenance Program. This program includes periodic nondestructive evaluations to detect loss of material due to erosion.

During the audit and review, the staff noted that the piping of the RCIC system is subject to FAC. LRA Table 3.2.1, item 3.2.1-19 credits the Periodic Surveillance and Preventive Maintenance Program for management of wall thinning. The GALL Report recommends GALL AMP XI.M17, "Flow-Accelerated Corrosion Program," to manage wall thinning. The Periodic Surveillance and Preventive Maintenance Program inspects wall thinning every five years but does not monitor or trend to predict areas of high wall thinning rates or trend thinning as does GALL AMP XI.M17. The staff requested justification for not monitoring and trending wall thinning for RCIC piping.

In a letter dated October 6, 2006, the applicant stated that:

> Flow-accelerated corrosion (FAC) is not an aging effect requiring management for RCIC system components in LRA Table 3.2.2-5, "Reactor Core Isolation Cooling System (RCIC) Summary of Aging Management Evaluation," due to infrequent system operation. As stated in LRA Section B.1.14, the Flow-Accelerated Corrosion Program applies to safety-related and nonsafety-related carbon steel components in systems containing high-energy fluids carrying two-phase or single-phase high-energy fluid $\geq$2% of plant operating time.
>
> Portions of RCIC steam supply and exhaust piping downstream of the strainers and steam traps are subjected to constricted flow and are therefore susceptible to erosion. The piping line item in LRA Table 3.2.2-5 that references Table 1 item 3.2.1-19 represents loss of material due to erosion, not FAC, for these sections of piping. As indicated in the table, the plant-specific Periodic Surveillance and Preventive Maintenance Program manages this loss of material due to erosion. Line item 3.2-19 in Table 3.2.1, "Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801," indicates that the plant-specific Periodic Surveillance and Preventive Maintenance Program includes periodic non-destructive evaluations to identify wall thinning, thereby managing loss of material due to erosion for this piping.
>
> As described in LRA Section B.1.24, under Monitoring and Trending attribute, PM and surveillance testing activities provide for monitoring and trending of aging degradation. Inspection and testing intervals are established such that they provide for timely detection of component degradation. Inspection and testing intervals are dependent on component material and environment and take into consideration industry- and plant-specific operating experience and manufacturers'

recommendations. Therefore, monitoring and trending of applicable aging mechanisms for RCIC piping is provided by the Periodic Surveillance and Preventive Maintenance Program.

Because the RCIC system is used infrequently and because the Periodic Surveillance and Preventive Maintenance Program manages loss of material due to erosion, the staff found this response acceptable.

On the basis of its review of AMR result lines and the additional information provided as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff found that the applicant addressed the AEM appropriately 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 the associated aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with the AMRs in the GALL Report. 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 for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Information in the Application. In LRA Section 3.2.2.2, the applicant provided further evaluation of aging management, as recommended by the GALL Report, for the ESF system components. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to cladding breach
- loss of material due to pitting and crevice corrosion
- reduction of heat transfer due to fouling
- hardening and loss of strength due to elastomer degradation
- loss of material due to erosion
- loss of material due to general corrosion and fouling
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion
- QA for aging management of nonsafety-related components

Staff Evaluation. For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the GALL Report and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.2.2.2. Details of the staff's audit are documented in Audit and Review Report Section 3.2.2.2. The staff's evaluation of the aging effects follows.

3.2.2.2.1 Cumulative Fatigue Damage

The staff reviewed the line items in Table 2s for the Emergency Safety Feature Systems in which fatigue-induced damage (which the AMR line items refer to as "fatigue-cracking") was shown as an AERM and "TLAA - Metal Fatigue" was credited as the basis for its management. This SER will refer to these AMR line items in Table 2s for the emergency safety feature systems as "AMRs on Non-Class 1 Fatigue" and to the relevant TLAA as the "TLAA on Metal Fatigue of Non-Class 1 Components."

The staff reviewed the applicant's evaluation of the Metal Fatigue TLAA for Non-Class 1 Components in LRA Section 4.3.2. The staff determined that the applicant had indicated that all of the AMRs on Non-Class 1 Fatigue of the emergency safety feature components in LRA Section 4.3.2 were within the scope of the B31.1 fatigue analysis; however, the staff determined that these AMRs on Non-Class 1 Fatigue did not clearly indicate which emergency safety feature components were designed to B31.1 code or which were designed to a different code. Thus, the staff could not conclude that the use of a TLAA on Metal Fatigue of Non-Class 1 Components was appropriate aging management for emergency safety feature commodity groups not designed to B31.1 code. The staff asked the applicant to respond to the following requests:

(1) Identify which design codes were applied to the non-piping commodity groups in the AMRs on Non-Class 1 Fatigue for the emergency safety feature systems.

(2) Clarify whether the design codes required a metal fatigue analysis, and summarize what type of metal fatigue analysis calculation was required by the design code, if applicable.

(3) Discuss how the metal fatigue analysis met 10 CFR 54.21(c)(1)(i), (ii), or (iii), if applicable.

(4) Propose an acceptable AMP to manage fatigue-induced damage for the period of extended operation if the design code for the particular Non-Class 1 commodity group did not require a metal fatigue analysis.

In a letter dated September 13, 2006, the applicant clarified that all of the commodity groups in the AMRs for Non-Class 1 fatigue for the emergency safety feature systems were designed in accordance with B31.1, with the following exceptions:

- RHR system heat exchanger shells and tubes designed in accordance with Section III Class C and ASME Section VIII, Division 1 requirements
- RHR pump casings designed to Section III, Class C requirements
- turbine casings in the RCIC and HPCI systems designed in accordance with National Electrical Manufacturers Association SM 23 requirements

The applicant clarified that the design codes for these specific components require no metal fatigue analyses. Therefore, the applicant amended the AMR line item and credited the One-Time

Inspection Program to manage fatigue-induced damage in these components in lieu of the TLAA on Metal Fatigue of Non-Class 1 Components. The applicant's One-Time Inspection Program determines whether a specific aging effect of concern occurs in components with no plant-specific operating experience with the aging effect. The applicant has not indicated any relevant operating experience with fatigue-induced damage in the RHR heat exchanger tubes and shells, RHR pump casings, or turbine casings for the HPCI and RCIC systems.

GALL AMP XI.M32, "One-Time Inspection," states that either an enhanced VT-1 (EVT-1) visual examination or volumetric examination techniques (*i.e.*, either ultrasonic or radiographic techniques) should be used to detect cracking in plant components. Furthermore, it states in the program description that a one-time inspection also may add assurance that aging that has not yet manifested itself, has not occurred, or that the evidence shows it is so insignificant that no AMP is warranted. The staff review of the applicant's One-Time Inspection Program (LRA AMP B.1.23) is in SER Section 3.0.3.1.8. The staff concluded that the applicant's One-Time Inspection Program is consistent with GALL AMP XI.M32 without exception, and is acceptable for implementation. Therefore, the staff concludes that it is appropriate to credit a one-time inspection of these components by either an EVT-1 or volumetric examination technique to determine whether fatigue-induced damage is an AERM for the period of extended operation.

For the remaining AMRs on Non-Class 1 Fatigue of the emergency safety feature systems, the applicant confirmed that the design code for the components in the AMRs is B31.1 and that the TLAA on Metal Fatigue is credited to manage fatigue-induced damage in these components. Therefore, the staff concludes that use of the Metal Fatigue TLAA of Non-Class 1 Components for managing fatigue-induced damage in these components is valid and acceptable because (1) these components are designed to B31.1 code, (2) B31.1 includes a metal fatigue analysis methodology for B31.1-designed components, and (3) LRA Section 4.3.2 includes a B31.1-based fatigue assessment for these components. The staff reviewed the Metal Fatigue TLAA to review the effectiveness to manage fatigue-induced damage in these components and its evaluation is documented in SER Section 4.3.2.2.

3.2.2.2.2 Loss of Material Due to Cladding

LRA Section 3.2.2.2.2 states that loss of material due to general corrosion of carbon steel PWR charging pump casings evaluated under SRP-LR Section 3.2.2.2.2, applies to PWRs only. The staff finds the applicant's evaluation acceptable because this aging effect does not apply to PNPS, a BWR plant.

3.2.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.3 against the following SRP-LR Section 3.2.2.2.3 criteria:

(1) LRA Section 3.2.2.2.3 states that the loss of material due to pitting and crevice corrosion for internal surfaces of SS piping and ESF system components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components including those in areas of stagnant flow.

SRP-LR Section 3.2.2.2.3 states that loss of material due to pitting and crevice corrosion may occur in internal surfaces of SS containment isolation piping, piping components, and piping elements exposed to treated water. The existing AMP monitors and controls water chemistry to mitigate degradation. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations with stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. A one-time inspection of select SS components at susceptible locations is an acceptable method to determine whether an aging effect does not occur or an aging effect is progressing very slowly such that component intended functions will be maintained during the period of extended operation.

The staff reviewed the One-Time Inspection Program and Water Chemistry Control – BWR Program. The staff determined that the addition of a one-time inspection along with water chemistry will inspect select SS components exposed to treated water at susceptible locations, *i.e.* stagnant areas, for loss of material due to pitting and crevice corrosion in subject ESF systems.

Therefore, the staff found that, based on the programs reviewed, the applicant has met the criteria for SRP-LR Section 3.2.2.2.3.1 for further evaluation.

(2) LRA Section 3.2.2.2.3 states that there are no SS ESF components in contact with a soil environment. Therefore, this item is not applicable.

SRP-LR Section 3.2.2.2.3 states that loss of material from pitting and crevice corrosion may occur in SS piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff concluded that this item is not applicable.

(3) In LRA Section 3.2.2.2.3 states that the loss of material from pitting and crevice corrosion for BWR SS piping and piping components exposed to treated water at PNPS is managed by the Water Chemistry Control – BWR Program. ESF systems at PNPS do not contain any components made of aluminum. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components crediting this program, including those in areas of stagnant flow.

SRP-LR Section 3.2.2.2.3 states that loss of material from pitting and crevice corrosion may occur in BWR SS and aluminum piping, piping components, and piping elements exposed to treated water. The existing AMP monitors and controls 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 with stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion does not occur. 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 does not occur or an aging effect is progressing very slowly such that component intended functions will be maintained during the period of extended operation.

The staff reviewed the One-Time Inspection Program and Water Chemistry Control – BWR Program and determined that these programs will inspect select SS components exposed to treated water at susceptible locations like stagnant areas for loss of material due to pitting and crevice corrosion in applicable ESF systems.

Therefore, the staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.3 for further evaluation.

(4) LRA Section 3.2.2.2.3 states that the loss of material from pitting and crevice corrosion of copper alloy and SS piping components exposed to lubricating oil is managed by the Oil Analysis Program, which periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. Plant-specific operating experience confirms the effectiveness of this program in maintaining contaminants within limits so corrosion does not affect component intended functions.

SRP-LR Section 3.2.2.2.3 states that loss of material from pitting and crevice corrosion may occur in SS and copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The applicant depends on operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, staff asked the applicant how it can make this statement if there has been no inspection.

In its response, the applicant stated that during routine maintenance on components that contain lubricating oil, visual inspections would detect degraded conditions that could be attributed to an ineffective Oil Analysis Program. The corrective action program has a low threshold for the detection of degraded conditions and would detect component corrosion or cracking. A review of plant-specific operating experience for the last five years showed no condition reports that would indicate an ineffective Oil Analysis Program. Also, no degraded component conditions like corrosion or cracking in a lubricating oil environment were indicated.

The applicant stated that during corrective and PM activities in the past five years, many visual inspections of components containing lubricating oil would have detected degraded conditions like corrosion or cracking that could be attributed to an ineffective Oil Analysis Program. No condition reports of degraded component conditions like corrosion or cracking in a lubricating oil environment followed these inspections. These past inspections serve in lieu of a one-time inspection to confirm the effectiveness of the Oil Analysis Program.

The staff reviewed the license renewal project operating experience review report and confirmed that the report showed no condition reports on degraded components in a lubricating oil environment. On the basis of periodic inspections of components in a lubricating oil environment during maintenance activities, and operating experience, the staff determined that the Oil Analysis Program is appropriate assurance that the effects of aging will be effectively managed through the period of extended operation. The staff's evaluation of the Oil Analysis Program is documented in SER Section 3.0.3.2.13. The staff found the program acceptable for managing aging degradation.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.4 for further evaluation.

(5) LRA Section 3.2.2.2.3 states that there are no outdoor SS tanks in ESF systems, and that this item is therefore not applicable.

SRP-LR Section 3.2.2.2.3 states that loss of material from pitting and crevice corrosion may occur in partially encased SS 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.

The staff concluded that this item is not applicable.

(6) LRA Section 3.2.2.2.3 states that there are no ESF system components exposed to internal condensation and that this item is therefore not applicable.

SRP-LR Section 3.2.2.2.3 states that loss of material from pitting and crevice corrosion may occur in SS piping, piping components, piping elements, and tanks exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff concluded that this item is not applicable.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.2.2.2.3. For those line items that apply to LRA Section 3.2.2.2.3, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.4 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.2.2.2.4 against the following SRP-LR Section 3.2.2.2.4 criteria:

(1) LRA Section 3.2.2.2.4 states that the reduction of heat transfer due to fouling for SS and copper alloy heat exchanger tubes exposed to lubricating oil in ESF systems is managed by the Oil Analysis Program, which periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to fouling. Plant-specific operating experience confirms the effectiveness of this program in maintaining contaminants within limits so fouling does not affect component intended functions.

SRP-LR Section 3.2.2.2.4 states that reduction of heat transfer due to fouling may occur in steel, SS, and copper alloy heat exchanger tubes exposed to lubricating oil. The existing AMP monitors and controls lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil chemistry may not always be fully effective in precluding fouling. Therefore, the effectiveness of lube oil chemistry control should be verified to ensure that fouling does not occur. 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 does not occur or an aging effect is progressing very slowly such that component intended functions will be maintained during the period of extended operation.

The applicant stated that it depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. The staff asked the applicant how it can make this statement if there has been no inspection.

In its response, the applicant stated that during routine maintenance on components that contain lubricating oil, visual inspections of these components would detect degraded conditions that could be attributed to an ineffective Oil Analysis Program. The corrective action program has a low threshold for the detection of degraded conditions and would detect component corrosion or cracking. In plant-specific operating experience for the last five years no condition reports indicated an ineffective Oil Analysis Program or degraded component conditions like fouling in a lubricating oil environment.

The applicant stated that during corrective and PM activities in the past five years, many visual inspections of components containing lubricating oil would have detected degraded conditions like fouling that could be attributed to an ineffective Oil Analysis Program. No condition reports of degraded component conditions like fouling in a lubricating oil environment followed these inspections. These past inspections serve in lieu of a one-time inspection to confirm the effectiveness of the Oil Analysis Program.

The staff reviewed the license renewal project operating experience review report and confirmed that there were no condition reports of degraded conditions of components in a lubricating oil environment. On the basis of periodic inspections of components in a lubricating oil environment during maintenance activities and operating experience reporting no degraded conditions, the staff determined that the Oil Analysis Program is appropriate assurance that the effects of aging will be effectively managed through the period of extended operation. The staff's evaluation of the Oil Analysis Program is documented in SER Section 3.0.3.2.13. The staff found the program acceptable for managing aging degradation.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.2.2.2.4.1 for further evaluation.

(2) LRA Section 3.2.2.2.4 states that the reduction of heat transfer due to fouling for SS heat exchanger tubes exposed to treated water in ESF systems is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components crediting this program, including those in areas of stagnant flow.

SRP-LR Section 3.2.2.2.4 states that reduction of heat transfer due to fouling may occur in SS heat exchanger tubes exposed to treated water. The existing program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may have been inadequate. Therefore, 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 does not occur. A one-time inspection is an acceptable method to ensure that reduction of heat transfer does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the One-Time Inspection Program and Water Chemistry Control – BWR Program and determined that these programs will inspect select components exposed to treated water at susceptible locations, like stagnant areas, for loss of material due to pitting and crevice corrosion, and reduction of heat transfer due to fouling, in applicable ESF systems.

The staff found that, based on the programs reviewed, the applicant has met the criterion of SRP-LR Section 3.2.2.2.4.1 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.2.2.2.4. For those line items that apply to LRA Section 3.2.2.2.4, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

The staff reviewed LRA Section 3.2.2.2.5 against the criteria in SRP-LR Section 3.2.2.2.5.

LRA Section 3.2.2.2.5 states that the Periodic Surveillance and Preventive Maintenance Program manages aging in elastomer components of the SGT system exposed to air. The program includes periodic visual or other nondestructive inspections and manipulations to manage cracking and changes in material properties.

SRP-LR Section 3.2.2.2.5 states that hardening and loss of strength due to elastomer degradation may occur in elastomer seals and components associated with the BWR SGT system ductwork and filters exposed to air-indoor uncontrolled. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff reviewed the Periodic Surveillance and Preventive Maintenance Program and determined that this program will visually inspect and manipulate elastomer components exposed to air at five-year intervals to detect elastomer degradation in the SGT system.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.2.2.2.5. For those line items that apply to LRA Section 3.2.2.2.5, 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).

3.2.2.2.6 Loss of Material Due to Erosion

LRA Section 3.2.2.2.6 states that loss of material due to erosion of the PWR high-pressure safety injection pump mini flow orifice evaluated under SRP-LR Section 3.2.2.2.6 applies to PWRs only. The staff finds the statement acceptable because this aging effect does not apply to PNPS, a BWR plant.

3.2.2.2.7 Loss of Material Due to General Corrosion and Fouling

The staff reviewed LRA Section 3.2.2.2.7 against the criteria in SRP-LR Section 3.2.2.2.7.

LRA Section 3.2.2.2.7 states that this item refers to loss of material due to general corrosion and fouling of steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to uncontrolled indoor air. The spray nozzles are copper alloy and SS and not subject to loss of material due to general corrosion in an indoor air environment. There are also no orifices in emergency core cooling systems exposed to indoor air environments (internal). This item is therefore not applicable.

SRP-LR Section 3.2.2.2.7 states that loss of material due to general corrosion and fouling can occur for steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled. This could result in plugging of the spray nozzles and flow orifices. This aging mechanism and effect will apply since the spray nozzles and flow orifices are occasionally wetted, even though the majority of the time this system is on standby. The wetting and drying of these components can accelerate corrosion and fouling. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff found that this item is not applicable.

3.2.2.2.8 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.8 against the following SRP-LR Section 3.2.2.2.8 criteria:

(1) LRA Section 3.2.2.2.8 states that the loss of material due to general, pitting, and crevice corrosion for BWR steel piping and ESF system components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components crediting this program, including those in areas of stagnant flow. The Periodic Surveillance and Preventive Maintenance Program also will manage loss of material for ADS piping wetted in the waterline region of the torus.

SRP-LR Section 3.2.2.2.8 states that loss of material due to general, pitting, and crevice corrosion may occur in BWR steel piping, piping components, and piping elements exposed to treated water. The existing AMP monitors and controls water chemistry for BWRs to mitigate degradation. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations with stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion does not occur. 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 does not occur or an aging effect is progressing very slowly such that component intended functions will be maintained during the period of extended operation.

The staff reviewed the One-Time Inspection Program and Water Chemistry Control – BWR Program and determined that these programs will inspect select steel components exposed to treated water at susceptible locations like stagnant areas for loss of material due to general, pitting, and crevice corrosion in the ADS. The staff found these programs acceptable.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.2.2.2.8.1 for further evaluation.

(2) LRA Section 3.2.2.2.8 states that steel containment isolation components exposed to treated water are all parts of other safety systems evaluated separately.
Section 3.2.2.2.8.1 describes the detection of aging effects in these components. The loss of material due to general, pitting, and crevice corrosion for internal surfaces of PCP steel piping and components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components crediting this program, including those in areas of stagnant flow.

SRP-LR Section 3.2.2.2.8 states that loss of material due to general, pitting, and crevice corrosion may occur in the internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water. The existing AMP monitors and controls water chemistry to mitigate degradation. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations with stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect does not occur or an aging effect is progressing very slowly such that component intended functions will be maintained during the period of extended operation.

The staff reviewed the One-Time Inspection Program and Water Chemistry Control – BWR Program and determined that these programs will manage loss of material due to general, pitting, and crevice corrosion for internal surfaces of PCP steel piping and components exposed to treated water. The staff found these programs acceptable.

The staff found that, based on the programs reviewed, the applicant has an acceptable method of SRP-LR Section 3.2.2.2.8.2 for further evaluation.

(3) LRA Section 3.2.2.2.8 states that the loss of material due to general, pitting, and crevice corrosion for steel piping and ESF system components exposed to lubricating oil is managed by the Oil Analysis Program, which periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. Plant-specific operating experience confirms the effectiveness of this program in maintaining contaminants within limits so corrosion does not affect component intended functions.

SRP-LR Section 3.2.2.2.8 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The applicant stated that it uses on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. The staff asked the applicant how it can make this statement if there has been no inspection.

In its response, the applicant stated that during routine maintenance on components that contain lubricating oil, visual inspections of these components would detect degraded conditions that could be attributed to an ineffective Oil Analysis Program. The corrective action program has a low threshold for the detection of degraded conditions and would detect component corrosion or cracking. In plant-specific operating experience for the last five years no condition reports indicated an ineffective Oil Analysis Program or degraded component conditions like corrosion or cracking in a lubricating oil environment.

The applicant stated that during corrective and PM activities in the past five years, many visual inspections of components containing lubricating oil would have detected degraded conditions like corrosion or cracking that could be attributed to an ineffective Oil Analysis Program. No condition reports of degraded component conditions like corrosion or cracking in a lubricating oil environment followed these inspections. These past inspections serve in lieu of a one-time inspection to confirm the effectiveness of the Oil Analysis Program.

The staff reviewed the license renewal project operating experience review report and confirmed that there were no condition reports of degraded conditions of components in a lubricating oil environment. On the basis that periodic inspections of components in a lubricating oil environment during maintenance activities and operating experience reporting no degraded conditions, the staff determined that the Oil Analysis Program and inspections are appropriate and provide assurance that the effects of aging are effectively managed through the period of extended operation. The staff's evaluation of the Oil Analysis Program is documented in SER Section 3.0.3.2.13. The staff found the program acceptable for managing aging degradation.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.2.2.2.8.3 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.2.2.2.8. For those line items that apply to LRA Section 3.2.2.2.8, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.2.2.2.9 against the criteria in SRP-LR Section 3.2.2.2.9.

LRA Section 3.2.2.2.9 states that the loss of material due to general, pitting, and crevice corrosion and MIC for steel (with or without coating or wrapping) piping and piping components buried in soil in ESF systems is managed by the Buried Piping and Tanks Inspection Program. This program will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel components. Buried components will be inspected when excavated during maintenance. There will be an inspection within the first 10 years of the period of extended operation unless an opportunistic inspection occurs within this 10-year period.

SRP-LR Section 3.2.2.2.9 states that loss of material due to general, pitting, crevice, and MIC may occur in steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material does not occur.

The staff review of the Buried Piping and Tanks Inspection Program, which is consistent with GALL AMP XI.M34. The staff's evaluation is documented in SER Section 3.0.3.2.1. On the basis of periodic, including opportunistic, inspections on buried piping, the staff determined that the Buried Piping and Tanks inspection Program is appropriate assurance that the effects of aging will be effectively managed through the period of extended operation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.2.2.2.9. For those line items that apply to LRA Section 3.2.2.2.9, 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).

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 for safety-related and nonsafety-related components.

3.2.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.2.2-1 through 3.2.2-7, the staff reviewed additional details concerning the results of the AMRs for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

LRA Tables 3.2.2-1 through 3.2.2-7, the applicant indicated, via notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information concerning how the aging effects will be managed. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

Staff Evaluation. 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.

Aging Effects in LRA Table 3.2.1 That are Not Applicable. The staff reviewed LRA Table 3.2.1, which summarizes aging management evaluations not applicable to PNPS for the ESF evaluated in the GALL Report.

LRA Table 3.2.1, item 3.2.1-20 discussion column states that the loss of fracture toughness due to thermal aging embrittlement of CASS piping, piping components, and piping elements exposed to treated water (borated or unborated) in excess of 482°F is not applicable because there are no CASS components in the ESF systems. On the basis that there are no CASS components in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-21 discussion column states that cracking due to cycling loading, stress corrosion, and cracking for high-strength steel closure bolting exposed to air with steam or water leakage is not applicable because there is no high-strength steel closure bolting in ESF systems. On the basis that there is no high-strength bolting in the ESF, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-26 discussion column states that the loss of material due to general, pitting, and crevice corrosion of steel piping, piping components, and piping elements exposed to CCW is not applicable because steel containment isolation components exposed to CCW are all parts of other safety systems evaluated separately. On the basis that there are no steel piping components and steel piping elements exposed to CCW in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-33 discussion column states that loss of material due to general, pitting, and crevice corrosion of steel encapsulation components exposed to uncontrolled indoor air is not applicable because the ESF systems include no steel encapsulation components. On the basis that there are no steel encapsulation components in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-36 discussion column states that the loss of material due to general, pitting, crevice, galvanic, and MIC and fouling of steel heat exchanger components exposed to raw water is not applicable because there are no steel heat exchanger components exposed to raw water in the ESF systems. On the basis that there are no steel heat exchanger components exposed to raw water in the ESF systems the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-37 discussion column states that the loss of material due to pitting, crevice, and MIC of SS piping, piping components, and piping elements exposed to raw water is not applicable because there are no SS components exposed to raw water in the ESF systems.

On the basis that there are no SS piping, piping components, and piping elements exposed to raw water in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-38 discussion column states that the loss of material due to pitting, crevice, and MIC and fouling of SS component internal surfaces exposed to raw water is not applicable because there are no SS components exposed to raw water in the ESF systems.

On the basis that there are no SS component internal surfaces exposed to raw water of applicable components in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-39 discussion column states that the loss of material due to pitting, crevice, and MIC and fouling of SS heat exchanger components exposed to raw water is not applicable because there are no SS heat exchanger components exposed to raw water in the ESF systems. On the basis that there are no SS heat exchanger components exposed to raw water in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-40 discussion column states that the reduction of heat transfer due to fouling of steel and SS heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water is not applicable because there are no steel or SS heat exchanger tubes exposed to raw water in the ESF systems. On the basis that there are no steel or SS heat exchanger tubes exposed to raw water in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-42 discussion column states that the loss of material due to selective leaching of gray cast iron piping, piping components, and piping elements exposed to CCW is not applicable because there are no gray cast iron components exposed to CCW in the ESF systems. On the basis that there are no gray cast iron components exposed to CCW in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-43 discussion column states that the loss of material due to selective leaching of gray cast iron piping, piping components, and piping elements exposed to soil is not applicable because there are no gray cast iron components exposed to soil in the ESF systems. On the basis that there are no gray cast iron components exposed to soil in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-50 discussion column states that the aging of aluminum piping, piping components, and piping elements exposed to uncontrolled internal or external air is not applicable because there are no aluminum components in the ESF systems. On the basis that there are no aluminum components in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-51 discussion column states that aging of galvanized steel ducting exposed to controlled indoor air is not applicable because galvanized steel surfaces are evaluated as steel for the ESF systems. The applicant takes no credit for the corrosion-resistant coating for galvanized steel. On the basis that no credit is taken for the corrosion-resistant coating and that galvanized steel is evaluated as steel in the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-54 discussion column states that aging of steel piping, piping components, and piping elements exposed to indoor controlled air is not applicable because there are no steel components of the ESF systems in indoor controlled air environments. All indoor air environments are conservatively considered uncontrolled. On the basis that all indoor air environments are conservatively considered uncontrolled for the ESF systems, the staff finds this aging effect not applicable to this component type.

LRA Table 3.2.1, item 3.2.1-55 discussion column states that aging of steel and SS piping, piping components, and piping elements in concrete is not applicable because there are no steel or SS components of the ESF systems embedded in concrete. On the basis that there are no steel or SS components embedded in concrete in the ESF systems, the staff finds this aging effect not applicable to this component type.

ESF AMR Line Items With No Aging Effect (LRA Tables 3.2.2-1 through 3.2.2-7, 3.3.2-14-7, 3.3.2-14-16, 3.3.2-14-25, and 3.3.2-14-28). LRA Tables 3.2.2-1 through 3.2.2-7, 3.3.2-14-7, 3.3.2-14-16, 3.3.2-14-25, and 3.3.2-14-28 show AMR line items with no aging effects found in the aging review process. Specific components, fabrication materials, and environments for which the applicant states that no aging effects were found are the following:

SS in an Air-Indoor Internal Environment. The staff determined that SS is highly resistant to corrosion in dry atmospheres in the absence of corrosive species (which would reflect indoor uncontrolled air) as cited in Metals Handbook, Volumes 3 (p. 65) and 13 (p. 555) (Ninth Edition, American Society for Metals International, 1980 and 1987). Components are not subject to moisture in a dry air environment (and indoor uncontrolled air would have limited humidity and condensation). Therefore, SS in an indoor, uncontrolled air environment exhibits no aging effect, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

Copper Alloy Less Than 15-Percent Zinc in an Air-Indoor Internal Environment. The staff determined that copper alloy less than 15 percent zinc in an air-indoor internal environment has no aging effect. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under the ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure as cited in *Metals Handbook*, Volume 13, "Corrosion" (American Society for Metals International, 1987).

On the basis of its review of industry research and operating experience, the staff found that an air indoor internal environment on copper alloy less than 15 percent zinc will not cause aging of concern during the period of extended operation. Therefore, the staff concluded that there are no applicable AERMs for copper alloy less than 15 percent zinc components exposed to an air indoor internal environment.

On the basis of its review, the staff found this item not applicable.

3.2.2.3.1 Residual Heat Removal 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 RHR system component groups.

In LRA Table 3.2.2-1, the applicant proposed to manage "loss of material – wear" of SS (tubing) of heat exchangers exposed to treated water greater than 270°F using the Heat Exchanger Monitoring Program (AMP B.1.15). The staff review of the Heat Exchanger Monitoring Program is documented in SER Section 3.0.3.3.1. The Heat Exchanger Monitoring Program will inspect heat exchangers for degradation using visual examination and eddy current testing. Heat exchanger tubes will be eddy current inspected to determine wall thickness. There will be visual inspections of heat exchanger heads, covers, and tube sheets for loss of material. On the basis of its review, the staff found the aging effect of loss of material of SS tubing exposed to treated water greater than 270°F effectively managed by the Heat Exchanger Monitoring Program. On this basis, the staff found management of loss of material in Table 3.2.2-1 acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Core Spray 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 core spray system component groups.

In LRA Table 3.2.2-2, the applicant proposed to manage loss of material (wear or erosion) of copper alloy greater than 15-percent zinc for cooling coils exposed to treated water (interior) or lube oil (exterior) environments using the Heat Exchanger Monitoring Program (AMP B.1.15). The staff review of the Heat Exchanger Monitoring Program, and its evaluation is documented in SER Section 3.0.3.3.1. The Heat Exchanger Monitoring Program will inspect heat exchangers for degradation using visual examination and eddy current testing. Cooling coils will be subject to eddy current inspection to determine wall thickness. There will be visual inspections of heat exchanger heads, covers, and tube sheets for loss of material. On the basis of its review, the staff found the aging effect of loss of material of copper alloy greater than 15 percent zinc cooling coils exposed to lube oil or treated water effectively managed by the Heat Exchanger Monitoring Program. On this basis, the staff found management of loss of material in LRA Table 3.2.2-2 acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.3 Automatic Depressurization 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 ADS component groups.

In LRA Table 3.2.2-3, the applicant proposed to manage cracking fatigue of SS for tee-quencher component types exposed to steam greater than 270°F (internal) using the metal fatigue TLAA.

In LRA Table 3.2.2-3, the applicant indicated 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). The staff's evaluation of this TLAA is addressed separately in SER Section 4. On the basis of its review the staff found the aging effect of cracking fatigue of SS exposed to steam greater than 270°F(internal) effectively managed by the metal fatigue TLAA. On this basis, the staff found management of cracking fatigue in Table 3.2.2-3 acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.4 High Pressure Coolant Injection System Summary of Aging Management Evaluation - LRA Table 3.2.2-4

The staff reviewed LRA Table 3.2.2-4, which summarizes the results of AMR evaluations for the HPCI system component groups.

In LRA Table 3.2.2-4, the applicant proposed to manage cracking fatigue of SS and nickel alloy for orifice, rupture disc, strainer, strainer housing, and tubing component types exposed to steam greater than 270 °F using the metal fatigue TLAA. LRA Table 3.2.2-4 indicates 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). The staff's evaluation of this TLAA is addressed separately in SER Section 4. On the basis of its review the staff found the aging effect of cracking fatigue of SS and nickel alloy exposed to steam greater than 270°F effectively managed by the metal fatigue TLAA. On this basis, the staff found management of cracking fatigue in Table 3.2.2-4 acceptable.

In LRA Table 3.2.2-4, the applicant proposed to manage loss of material due to wear of copper alloy greater than 15-percent zinc of heat exchanger tubes exposed to treated water (interior) or lube oil (exterior) environments using the Heat Exchanger Monitoring Program. The staff's review of the Heat Exchanger Monitoring Program is documented in SER Section 3.0.3.3.1. The Heat Exchanger Monitoring Program will inspect heat exchangers for degradation using visual examination and eddy current testing. Heat exchanger tubes will be subjected to eddy current inspection to determine wall thickness. There will be visual inspections of heat exchanger heads, covers, and tube sheets for loss of material. On the basis of its review the staff found the aging effect of loss of material of copper alloy greater than 15 percent zinc cooling coils exposed to lube oil or treated water effectively managed by the Heat Exchanger Monitoring Program. On this basis, the staff found management of loss of material in LRA Table 3.2.2-4 acceptable.

In LRA Table 3.2.2-4, the applicant proposed to manage cracking of SS (tubing) of heat exchangers exposed to lubricating oil using the Oil Analysis Program (AMP B.1.22). The staff review of the Oil Analysis Program is documented in SER Section 3.0.3.2.13. The Oil Analysis Program maintains oil systems free of contaminants (primarily water and particulates) to preserve an environment not conducive to loss of material, cracking, or fouling. The Oil Analysis Program does not vary its effectiveness by inspection or other means; rather, the applicant depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. Review of plant-specific and industry operating experience and maintenance activities indicate that maintenance of the oil environment alone effectively manages SS cracking. This evaluation is documented in SER Section 3.2.2.2.8. On the basis of its review the staff found the aging effect of loss of material of SS tubing exposed to lubricating oil effectively managed by the Oil Analysis Program. On this basis, the staff found management of loss of material in LRA Table 3.2.2-4 acceptable.

In LRA Table 3.2.2-4, the applicant proposed to manage cracking and loss of material of nickel alloy strainers exposed to steam greater than 270°F using the Water Chemistry Control – BWR

Program. The staff review of the Water Chemistry Control -- BWR Program is documented in SER Section 3.0.3.1.13. The Water Chemistry Control – BWR Program optimizes the primary water chemistry to minimize potential loss of material and cracking by limiting RCS contaminant levels that could cause loss of material and cracking. Table 3.2.1 states in the discussion column that the One-Time Inspection Program will verify the effectiveness of the water chemistry control program. However, for Table 3.2.2-4 line items referring to LRA Table 3.2.1 line items, only the Water Chemistry Control – BWR Program is credited. To resolve the discrepancy the staff asked why the One-Time Inspection Program was not credited in the Table 2 line items that refer to this Table 1 line item.

In a letter dated July 19, 2006, the applicant stated that the effectiveness of the Water Chemistry Control – Auxiliary Systems Program, Water Chemistry Control – BWR Program, and Water Chemistry Control – Closed Cooling Water Program is confirmed by the One-Time Inspection Program. For further clarification, the applicant revised LRA Appendix A for these three water chemistry control programs to include the sentence "The One-Time Inspection Program will confirm the effectiveness of the program."

On the basis of its review the staff found the aging effect of cracking and loss of material, of nickel alloy exposed to steam greater than 270°F, effectively managed by the Water Chemistry Control – BWR Program. On this basis, the staff found management of cracking described in LRA Table 3.2.2-4 acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.5 Reactor Core Isolation Cooling System Summary of Aging Management Evaluation – LRA Table 3.2.2-5

The staff reviewed LRA Table 3.2.2-5, which summarizes the results of AMR evaluations for the RCIC system component groups.

In LRA Table 3.2.2-5, the applicant proposed to manage loss of material from wear of copper alloy greater than 15-percent zinc heat exchanger tubes exposed to lube oil (exterior) using the Heat Exchanger Monitoring Program. The staff review of the Heat Exchanger Monitoring Program is documented in SER Section 3.0.3.3.1. The Heat Exchanger Monitoring Program will inspect heat exchangers for degradation using visual examination and eddy current testing. Heat exchanger tubes will be subjected to eddy current inspection to determine wall thickness. There will be visual inspections of heat exchanger heads, covers, and tube sheets for loss of material. On the basis of its review, the staff found the aging effect of loss of material of copper alloy greater than 15 percent zinc cooling heat exchanger tubes exposed to lube oil effectively managed by the Heat Exchanger Monitoring Program. On this basis, the staff found management of loss of material described in LRA Table 3.2.2-5 acceptable.

In LRA Table 3.2.2-5, the applicant proposed to manage cracking due to fatigue of SS for strainer, orifice, and tubing component types exposed to steam greater than 270°F using the metal fatigue TLAA. In LRA Table 3.2.2-5, the applicant indicated 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). The staff's review of the applicant's TLAA is addressed separately in SER Section 4. On the basis of its review, the staff found the aging effect of cracking due to fatigue of SS exposed to steam greater than 270°F effectively managed by the metal fatigue TLAA. On this basis, the staff found management of cracking due to fatigue described in LRA Table 3.2.2-5 acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.6 Standby Gas Treatment System Summary of Aging Management Evaluation – LRA Table 3.2.2-6

The staff reviewed LRA Table 3.2.2-6, which summarizes the results of AMR evaluations for the standby gas treatment system component groups.

The results of these evaluations are all consistent with the GALL Report.

3.2.2.3.7 Primary Containment Penetrations Summary of Aging Management Evaluation – LRA Table 3.2.2-7

The staff reviewed LRA Table 3.2.2-7, which summarizes the results of AMR evaluations for PCP component groups.

The results of these evaluations are all consistent with the GALL Report.

3.2.2.3.8 Core Spray System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-7

The staff reviewed LRA Table 3.3.2-14-7, which summarizes the results of AMR evaluations for the core spray system nonsafety-related component groups affecting safety-related systems.

The results of these evaluations are all consistent with the GALL Report.

3.2.2.3.9 High Pressure Coolant Injection System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-16

The staff reviewed LRA Table 3.3.2-14-16, which summarizes the results of AMR evaluations for the HPCI system nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-16, the applicant proposed to manage cracking due to fatigue of SS and for orifice and rupture disc component types exposed to steam greater than 270 °F using the metal fatigue TLAA. In LRA Table 3.2.2-4, the applicant indicated 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). The staff's review of the applicant's TLAA is addressed separately in SER Section 4. On the basis of its review, the staff found the aging effect of cracking due to fatigue of SS and for components exposed to steam greater than 270 °F effectively managed by the metal fatigue TLAA. On this basis, the staff found management of cracking fatigue described in LRA Table 3.2.2-4 acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.10 Reactor Core Isolation Cooling System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-25

The staff reviewed LRA Table 3.3.2-14-25, which summarizes the results of AMR evaluations for the RCIC system nonsafety-related component groups affecting safety-related systems.

The results of these evaluations are all consistent with the GALL Report.

3.2.2.3.11 Residual Heat Removal System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-28

The staff reviewed LRA Table 3.3.2-14-28, which summarizes the results of AMR evaluations for the RHR system nonsafety-related component groups affecting safety-related systems.

The results of these evaluations are all consistent with the GALL Report.

3.2.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the ESF system components, that are within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3 Aging Management of Auxiliary Systems

This section of the SER documents the staff's review of the applicant's AMR results for the auxiliary systems components and component groups of the following:

- SLC system
- SSW system
- reactor building CCW system
- EDG system
- SBO diesel generator system
- security diesel
- fuel oil system
- IA system
- fire protection-water system
- fire protection-halon system
- heating, ventilation and air conditioning systems

- primary containment atmosphere control
- fuel pool cooling and fuel handling and storage systems
- miscellaneous systems in-scope for 10 CFR 54.4(a)(2)

3.3.1 Summary of Technical Information in the Application

In LRA Section 3.3, the applicant provided AMR results for the auxiliary systems components and component groups. In LRA Table 3.3.1, "Summary of Aging Management Evaluations for the Auxiliary Systems," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the auxiliary systems components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of AERMs. These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of 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, that are 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 confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL 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 Audit and Review Report Section 3.3.2.1 and are summarized in SER Section 3.3.2.1.

In the onsite audit, the staff also selected AMRs that were 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 acceptance criteria in SRP-LR Section 3.3.2.2. The staff's audit evaluations are documented in Audit and Review Report Section 3.3.2.2 and are summarized in SER Section 3.3.2.2.

In the onsite audit, the staff also conducted a technical review of the remaining AMRs not consistent with, or not addressed in, the GALL Report, including an evaluation of whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in Audit and Review Report Section 3.3.2.3 and are summarized in SER Section 3.3.2.3.

Finally, the staff reviewed the UFSAR AMP summary descriptions supplement for whether they adequately described the programs credited with managing or monitoring aging for the auxiliary systems components.

The staff noted that the applicant has included all the 35 miscellaneous systems in-scope for 10 CFR 54.4(a)(2) in Section 3.3, "Auxiliary Systems," Tables 3.3.2-14-1 through 3.3.2-14-35. However, four of these systems are ESF systems and should have been included in Section 3.2, and 10 of these systems are in steam and power conversion (S&PC) systems and should have been included in Section 3.4. The Table 2 line items that apply to these 14 systems refer to Table 3.2.1 and Table 3.4.1 line items in the Table 1 line item reference column. The Audit and Review Report and this SER preparation are based on systems as defined in SRP-LR Section 3.2, "ESF Systems," Section 3.3, "Auxiliary Systems," and Section 3.4, "S&PC Systems." The staff asked the applicant to justify why the nonsafety-related systems of ESF and S&PC systems were included in the auxiliary systems section.

In response the applicant stated that the AMR of the systems that have functions that met 10 CFR 54.4(a)(2) criteria for physical interaction was done separately from the review of systems with intended functions that met 10 CFR 54.4(a)(1) or (a)(3). The results of the review were presented separately for review separately on the basis of physical proximity rather than system function to allow the reviewer to see which system component types were included in 10 CFR 54.4(a)(2) for physical interaction. As most of these are auxiliary systems, they were added as part of the auxiliary system section.

The staff reviewed the response and discussed it further with the applicant. The staff agreed that it made sense to have these systems in their own specific table; however, only 60 percent of these systems were auxiliary systems and, as each system was in its own table, these tables should have been numbered and included in ESF, auxiliary, or S&PC system sections as appropriate for ease of preparation of the Audit and Review Report and SER and to make these documents easier to understand. These tables are included in their respective system sections in this SER as follows:

- Section 3.2 – Tables 3.3.2-14-7, 3.3.2-14-16, 3.3.2-14-25, and 3.3.2-14-28
- Section 3.3 – Tables 3.3.2-14-2, 3.3.2-14-6, 3.3.2-14-8, 3.3.2-14-12 to -15, 3.3.2-14-19 to -24, 3.3.2-14-26, 3.3.2-14-27, and 3.3.2-14-29 to -34
- Section 3.4 – Tables 3.3.2-14-1, 3.3.2-14-3, 3.3.2-14-4, 3.3.2-14-5, 3.3.2-14-9, 3.3.2-14-10, 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18, and 3.3.2-14-35

Table 3.3-1 summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs, listed in LRA Section 3.3, that are 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	AMP in LRA	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 Standard Review Plan, Section 4.7 for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1).	N/A	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.1)
Steel and SS 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)	TLAA	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.1)
SS heat exchanger tubes exposed to treated water (3.3.1-3)	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	N/A	Not applicable (See SER Section 3.3.2.2.2)
SS piping, piping components, and piping elements exposed to sodium pentaborate solution > 60°C (> 140°F) (3.3.1-4)	Cracking due to SCC	Water Chemistry and One-Time Inspection	N/A	Not applicable (See SER Section 3.3.2.2.3)
SS and stainless clad steel heat exchanger components exposed to treated water > 60°C (> 140°F) (3.3.1-5)	Cracking due to SCC	A plant-specific AMP is to be evaluated.	Water Chemistry Control – BWR Program One-Time Inspection Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.3)
SS diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-6)	Cracking due to SCC	A plant-specific AMP is to be evaluated.	Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS non-regenerative heat exchanger components exposed to treated borated water > 60°C (> 140°F) (3.3.1-7)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.	N/A	Not applicable to BWRs (See SER Section 3.3.2.2.4)
SS regenerative heat exchanger components exposed to treated borated water > 60°C (> 140°F) (3.3.1-8)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to SCC and cyclic loading. A plant-specific AMP is to be evaluated.	N/A	Not applicable to BWRs (See SER Section 3.3.2.2.4)
SS high-pressure pump casing in PWR chemical and volume control system (3.3.1-9)	Cracking due to SCC and cyclic loading	Water Chemistry and a plant-specific verification program. The AMP is to be augmented by verifying the absence of cracking due to SCC and cyclic loading. A plant-specific AMP is to be evaluated.	N/A	Not applicable to BWRs (See SER Section 3.3.2.2.4)
High-strength steel closure bolting exposed to air with steam or water leakage. (3.3.1-10)	Cracking due to SCC, 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.	N/A	Not applicable
Elastomer seals and components exposed to air - indoor uncontrolled (internal/external) (3.3.1-11)	Hardening and loss of strength due to elastomer degradation	A plant-specific AMP is to be evaluated	Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.5)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Elastomer lining exposed to treated water or treated borated water (3.3.1-12)	Hardening and loss of strength due to elastomer degradation	A plant-specific AMP that determines and assesses the qualified life of the linings in the environment is to be evaluated.	N/A	Not applicable (See SER Section 3.3.2.2.5)
Boral, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water or treated borated water (3.3.1-13)	Reduction of neutron-absorbing capacity and loss of material due to general corrosion	A plant-specific AMP is to be evaluated	Water Chemistry Control – BWR Program	Consistent with GALL Report, which recommends further evaluation (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	Oil Analysis Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.7)
Steel reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil (3.3.1-15)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	N/A	Not applicable (See SER Section 3.3.2.2.7)
Steel reactor coolant pump oil collection system tank exposed to lubricating oil (3.3.1-16)	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection to evaluate the thickness of the lower portion of the tank	N/A	Not applicable (See SER Section 3.3.2.2.7)
Steel piping, piping components, and piping elements exposed to treated water (3.3.1-17)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Water Chemistry Control – BWR Program One-Time Inspection Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.7)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS and steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust (3.3.1-18)	Loss of material/general (steel only), pitting and crevice corrosion	A plant-specific AMP is to be evaluated	Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.7)
Steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil (3.3.1-19)	Loss of material due to general, pitting, crevice, and MIC	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	Buried Piping and Tanks Inspection Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.8)
Steel piping, piping components, piping elements, and tanks exposed to fuel oil (3.3.1-20)	Loss of material due to general, pitting, crevice, and MIC, and fouling	Fuel Oil Chemistry and One-Time Inspection	Diesel Fuel Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.9)
Steel heat exchanger components exposed to lubricating oil (3.3.1-21)	Loss of material due to general, pitting, crevice, and MIC, and fouling	Lubricating Oil Analysis and One-Time Inspection	Oil Analysis Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.9)
Steel with elastomer lining or SS 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	N/A	Not applicable (See SER Section 3.3.2.2.10)
SS and steel with SS 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	Water Chemistry Control – BWR Program One-Time Inspection Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.10)
SS 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	Water Chemistry Control – BWR Program One-Time Inspection Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.10)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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 AMP is to be evaluated.	System Walkdown Program Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.10)
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	Oil Analysis Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.10)
SS HVAC ducting and aluminum HVAC piping, piping components and piping elements exposed to condensation (3.3.1-27)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	System Walkdown Program Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.10)
Copper alloy fire protection piping, piping components, and piping elements exposed to condensation (internal) (3.3.1-28)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	Periodic Surveillance and Preventive Maintenance Program One-Time Inspection Program Instrument Air Quality Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.10)
SS piping, piping components, and piping elements exposed to soil (3.3.1-29)	Loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated.	N/A	Not applicable (See SER Section 3.3.2.2.10)
SS 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	Water Chemistry Control – BWR Program One-Time Inspection Program	Consistent with GALL Report, which recommends further evaluation (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	Water Chemistry Control – BWR Program One-Time Inspection Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.11)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS, aluminum and copper alloy piping, piping components, and piping elements exposed to fuel oil (3.3.1-32)	Loss of material due to pitting, crevice, and MIC	Fuel Oil Chemistry and One-Time Inspection	Diesel Fuel Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.12)
SS piping, piping components, and piping elements exposed to lubricating oil (3.3.1-33)	Loss of material due to pitting, crevice, and MIC	Lubricating Oil Analysis and One-Time Inspection	Oil Analysis Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.3.2.2.12)
Elastomer seals and components exposed to air - indoor uncontrolled (internal or external) (3.3.1-34)	Loss of material due to Wear	A plant-specific AMP is to be evaluated.	N/A	Not applicable (See SER Section 3.3.2.2.13)
Steel with SS cladding pump casing exposed to treated borated water (3.3.1-35)	Loss of material due to cladding breach	A plant-specific AMP is to be evaluated. Reference NRC IN 94-63, "Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks."	N/A	Not applicable to BWRs (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	Boraflex Monitoring Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
SS piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.3.1-37)	Cracking due to SCC, IGSCC	BWR Reactor Water Cleanup System	Water Chemistry Control – BWR Program One-Time Inspection Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
SS piping, piping components, and piping elements exposed to treated water > 60°C (> 140°F) (3.3.1-38)	Cracking due to SCC	BWR Stress Corrosion Cracking and Water Chemistry	Water Chemistry Control – BWR Program One-Time Inspection Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS BWR spent fuel storage racks exposed to treated water > 60°C (> 140°F) (3.3.1-39)	Cracking due to SCC	Water Chemistry	N/A	Not applicable (See SER Section 3.3.2.3)
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	N/A	Not applicable (See SER Section 3.3.2.1)
High-strength steel closure bolting exposed to air with steam or water leakage (3.3.1-41)	Cracking due to cyclic loading, SCC	Bolting Integrity	N/A	Not applicable (See SER Section 3.3.2.3)
Steel closure bolting exposed to air with steam or water leakage (3.3.1-42)	Loss of material due to general corrosion	Bolting Integrity	Bolting Integrity	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
Steel bolting and closure bolting exposed to air - indoor uncontrolled (external) or air - outdoor (External) (3.3.1-43)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	Bolting Integrity	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
Steel compressed air system (CAS) closure bolting exposed to condensation (3.3.1-44)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	Bolting Integrity	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	Bolting Integrity	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS 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 SCC	Closed-Cycle Cooling Water System	Water Chemistry Control – Closed Cooling Water Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	Water Chemistry Control – Closed Cooling Water Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	Water Chemistry Control – Closed Cooling Water Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
SS; steel with SS cladding heat exchanger components exposed to closed cycle cooling water (3.3.1-49)	Loss of material due to MIC	Closed-Cycle Cooling Water System	Water Chemistry Control – Closed Cooling Water Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
SS 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	Water Chemistry Control – Closed Cooling Water Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	Water Chemistry Control – Closed Cooling Water Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel, SS, 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	Water Chemistry Control – Closed Cooling Water Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
Steel CAS 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	Instrument Air Quality Program One-Time Inspection Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
SS CAS 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	Instrument Air Quality Program One-Time Inspection Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
Steel ducting closure bolting exposed to air - indoor uncontrolled (external) (3.3.1-55)	Loss of material due to general corrosion	External Surfaces Monitoring	System Walkdown Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	System Walkdown Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	System Walkdown Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	System Walkdown Program Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	System Walkdown Program Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	System Walkdown Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	Not used	See SER Section 3.3.2.1.5 for further discussion.
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	N/A	Not applicable (See SER Section 3.3.2.3)
Steel fire rated doors exposed to air - outdoor or air - indoor uncontrolled (3.3.1-63)	Loss of material due to Wear	Fire Protection	Not used	Evaluated in SER Section 3.5.
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	Fire Protection and Diesel Fuel Monitoring	See SER Section 3.3.2.1.6 for further discussion.
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	Not used	Evaluated in SER Section 3.5.

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	Not used	Evaluated in SER Section 3.5.
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	Not used	Evaluated in SER Section 3.5.
Steel piping, piping components, and piping elements exposed to raw water (3.3.1-68)	Loss of material due to general, pitting, crevice, and MIC, and fouling	Fire Water System	Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
SS 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	Not used	Not consistent with the GALL Report. Fire Water System at PNPS is considered to be treated water rather than raw water. See SER Section 3.3.2.3.9 for further discussion.
Copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-70)	Loss of material due to pitting, crevice, and MIC, and fouling	Fire Water System	Not used	Not consistent with the GALL Report. Fire Water System at PNPS is considered to be treated water rather than raw water. See SER Section 3.3.2.3.9 for further discussion.
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	Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel HVAC ducting and components internal surfaces exposed to condensation (Internal) (3.3.1-72)	Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) MIC	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	System Walkdown Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	Not used	Evaluated in SER Section 3.5.
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	Not used	Evaluated in SER Section 3.5.
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	Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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 MIC, fouling, and lining/coating degradation	Open-Cycle Cooling Water System	Service Water Integrity Program Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
Steel heat exchanger components exposed to raw water (3.3.1-77)	Loss of material due to general, pitting, crevice, galvanic, and MIC, and fouling	Open-Cycle Cooling Water System	N/A	Not applicable (See SER Section 3.3.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS, 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	Service Water Integrity Program Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
SS 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	Service Water Integrity Program Periodic Surveillance and Preventive Maintenance Program One-Time Inspection Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
SS and copper alloy piping, piping components, and piping elements exposed to raw water (3.3.1-80)	Loss of material due to pitting, crevice, and MIC	Open-Cycle Cooling Water System	N/A	Not applicable (See SER Section 3.3.2.3)
Copper alloy piping, piping components, and piping elements, exposed to raw water (3.3.1-81)	Loss of material due to pitting, crevice, and MIC, and fouling	Open-Cycle Cooling Water System	Service Water Integrity Program Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
Copper alloy heat exchanger components exposed to raw water (3.3.1-82)	Loss of material due to pitting, crevice, galvanic, and MIC, and fouling	Open-Cycle Cooling Water System	Service Water Integrity Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
SS 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	Service Water Integrity Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Copper alloy > 15% Zn piping, piping components, piping elements, and heat exchanger components exposed to raw water, treated water, or closed cycle cooling water (3.3.1-84)	Loss of material due to selective leaching	Selective Leaching of Materials	Selective Leaching Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	Selective Leaching Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.3.2.1)
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	Not used	Evaluated in SER Section 3.5.
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	N/A	Not applicable to BWRs
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	N/A	Not applicable to BWRs
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	N/A	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS and steel with SS 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 SCC	Water Chemistry	N/A	Not applicable to BWRs
SS and steel with SS 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	N/A	Not applicable to BWRs
Galvanized steel piping, piping components, and piping elements exposed to air - indoor uncontrolled (3.3.1-92)	None	None	N/A	Not applicable (See SER Section 3.3.2.3)
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	None	Consistent with the GALL Report
SS and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.3.1-94)	None	None	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	None	Consistent with the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel and SS piping, piping components, and piping elements in concrete (3.3.1-96)	None	None	None	Consistent with the GALL Report
Steel, SS, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas (3.3.1-97)	None	None	None	Consistent with the GALL Report
Steel, SS, and copper alloy piping, piping components, and piping elements exposed to dried air (3.3.1-98)	None	None	None	Not applicable (See SER Section 3.3.2.3)
SS and copper alloy < 15% Zn piping, piping components, and piping elements exposed to air with borated water leakage (3.3.1-99)	None	None	None	Not applicable to BWRs

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

Summary of Technical Information in the Application. LRA Section 3.3.2.1 identifies the materials, environments, and AERMs and the following programs that manage the effects of aging for the auxiliary systems components:

- Boraflex Monitoring Program
- Buried Piping and Tanks Inspection Program
- Diesel Fuel Monitoring Program
- Fire Protection Program
- Fire Water System Program

- Flow-Accelerated Corrosion Program
- Heat Exchanger Monitoring Program
- Instrument Air Quality Program
- Oil Analysis Program
- One-Time Inspection Program
- Periodic Surveillance and Preventive Maintenance Program
- Selective Leaching Program
- Service Water Integrity Program
- System Walkdown Program
- Water Chemistry Control - Auxiliary Systems Program
- Water Chemistry Control - BWR Program
- Water Chemistry Control - Closed Cooling Water Program

LRA Tables 3.3.2-1 through 3.3.2-13 and Tables 3.3.2-14-2, 3.3.2-14-6, 3.3.2-14-8, 3.3.2-14-12 to -15, 3.3.2-14-19 to -24, 3.3.2-14-26, 3.3.2-14-27, and 3.3.2-14-29 to -34, summarize AMRs for the auxiliary systems components and indicate AMRs claimed to be consistent with the GALL Report.

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant claimed consistency with the GALL Report and for which the GALL Report does not recommend further evaluation, the staff 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 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 AMP. The staff audited these line items to verify consistency with the GALL Report and verified that the identified exceptions to the GALL AMPs had been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL 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 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 AMP. The staff audited these line items to verify consistency with the GALL Report and verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL 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 consistent with the GALL AMP and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in Audit and Review Report Section 3.3.2.1. 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 AMRs. The staff's evaluation is discussed below.

3.3.2.1.1 Loss of Material, Loss of Preload, and Cracking of Carbon Steel and SS Bolting in Various External Environments

The LRA does not include a Bolting Integrity Program. Instead, the applicant credits alternate programs like the System Walkdown, Service Water Integrity, and Buried Piping and Tanks Inspection programs. GALL AMP XI.M18, "Bolting Integrity," makes several recommendations in the 10-element evaluation (*e.g.*, selection of bolting materials, use of lubricants and sealants, and additional recommendations of NUREG-1339). The alternate programs may be acceptable for inspection; however, they do not address preventive actions. For Section 3.3, this fact applies to Table 3.3.1, items 19, 27, 42, 43, 44, 55, 58, 78, and 94. The staff asked the applicant to clarify how it meets these recommendations or justify why there should be no Bolting Integrity Program.

In a letter dated July 19, 2006, the applicant included Bolting Integrity Program. This program is consistent with GALL AMP XI.M18, "Bolting Integrity," and covers bolting within the scope of license renewal, including (1) safety-related bolting, (2) bolting for nuclear steam supply system component supports, (3) bolting for other pressure-retaining components, including nonsafety-related bolting, and (4) structural bolting (actual measured yield strength greater than 150 ksi). The aging management of reactor head closure studs is addressed by Reactor Head Closure Studs Program which is consistent with GALL AMP XI.M3 and not included in this program. Therefore, the aging effects of component type of bolting in all mechanical systems, except reactor head closure studs, is managed by the Bolting Integrity Program instead of any other programs in the LRA Table 3.x.2-2 items. The staff's evaluation of this program is documented in SER Section 3.0.3.2.20. The staff found the program acceptable.

3.3.2.1.2 Cracking Due to Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking

The discussion column of LRA Table 3.3.1, item 3.3.1-37 states that cracking of SS RWCU system components exposed to treated water greater than 140°F is managed by the Water

Chemistry Control – BWR and One-Time Inspection programs. During the audit and review, the staff noted that 10 AMR result lines pointing to Table 3.1.1, item 3.1.1-37 refer to Note E. The only components to which this GALL Report line item applies are included in-scope only under 10 CFR 54.4(a)(2) criteria.

The staff reviewed the AMR result lines referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M25, "Reactor Water Cleanup System," the applicant proposed to use the Water Chemistry Control – BWR and One-Time Inspection programs. The applicant stated that Supplement 1 to GL 88-01 states that IGSCC inspection of RWCU piping outside of the containment isolation valves is recommended only until actions per GL 89-10 on motor-operated valves are completed. Because the applicant has completed all actions requested in GL 89-10 satisfactorily, it uses the Water Chemistry Control – BWR Program in lieu of the BWR Reactor Water Cleanup System Program to manage this potential aging effect. However, the GALL AMP also states that, in addition to meeting this supplement criterion, piping is made of material resistant to IGSCC. The staff asked the applicant to confirm the grade of SS material its resistance to IGSCC.

In response the applicant stated that the original Type 304 SS piping and fittings between drywell penetration X-14 and the 6-by-4 inch reducer downstream of MO-1201-5 were replaced with Type 316L SS. The staff reviewed the response and determined that Type 316L is low-carbon grade (less than 0.035 percent carbon) SS resistant to IGSCC. Furthermore, Supplement 1 to GL 88-01 indicates that low-grade carbon SS like 304L or 316L is resistant to IGSCC. On these bases, the staff found the applicant's use of the Water Chemistry Control – BWR and One-Time Inspection programs for aging management of these RWCU components acceptable.

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 found that the applicant appropriately addressed the AEM as recommended by the GALL Report.

3.3.2.1.3 Loss of Material Due to General, Pitting, and Crevice Corrosion

The discussion column of LRA Table 3.3.1, item 3.3.1-40 states that loss of material of steel tanks in diesel fuel oil system exposed to air-outdoor external environment is managed by the System Walkdown Program. During the audit and review, the staff noted that the AMR result line in LRA Table 3.3.2-7, "Fuel Oil System," pointing to Table 3.1.1, item 3.1.1-40 refers to Note E.

The staff reviewed the AMR result line referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M29, "Aboveground Steel Tanks Program," the applicant proposed the System Walkdown Program. The staff reviewed the System Walkdown Program and determined that this program may be an acceptable alternate for the Aboveground Steel Tanks Program for inspection but that the Aboveground Steel Tanks Program has some preventive actions not addressed in the System Walkdown Program. Furthermore, the GALL AMP specifies wall thickness measurement of the tank bottom if supported on earthen or concrete foundations.

The staff asked the applicant to clarify whether the steel tanks have protective paint or coating in accordance with industry practice and whether sealant or caulking is applied at the interface edge between the tank and the foundation as per GALL AMP XI.M29. The staff asked the applicant to confirm how the tank is supported.

In response the applicant stated that no carbon steel tanks in the fuel oil system exposed to air-outdoor are included within the scope of license renewal.

In its response dated July 19, 2006, the applicant revised LRA Table 3.3.1, item 3.3.1-40, to remove reference to the System Walkdown Program as follows:

> Not applicable. There are no steel tanks in the diesel fuel oil system exposed to air-outdoor (external).
>
> LRA Table 3.3.2-7 line item with component type of tank exposed to air- outdoor (ext) is removed.

On the basis that the carbon steel tank is not within the scope of license renewal and item 3.3.1-40 is not applicable, the staff found the response acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.4 Loss of Material Due to General Corrosion

The discussion column of LRA Table 3.3.1, item 3.3.1-58 states that loss of material of steel external surfaces exposed to air-indoor uncontrolled, air-outdoor, and condensation environments is managed by the System Walkdown Program. During the audit and review, the staff noted that the AMR result lines pointing to Table 3.1.1, item 3.1.1-58, credit the Fire Protection Program to manage loss of material for the tank in the halon system. The applicant was asked to justify why the Fire Protection Program is not in the discussion column of Table 3.3.1, item 3.3.1-58.

In its response dated July 19, 2006, the applicant revised the LRA Table 3.3.1, item 3.3.1-58, discussion as follows:

> The System Walkdown Program manages loss of material for external surfaces of steel components. For some fire protection system components, the Fire Protection Program will manage loss of material.
>
> In LRA Table 3.3.2-10, the note for the line item with component type of tank exposed to air – indoor (ext) is changed from "B" to "E."

On the basis of the applicant's revision of the discussion of item 3.3.1-58 to include the Fire Protection Program, the staff found the response acceptable. However, the applicant credits the Fire Protection Program as an alternate to GALL AMP XI.M36, "External Surfaces Monitoring."

The staff reviewed the Fire Protection Program and determined that this program is an acceptable alternate to GALL AMP XI.M36 because its periodic inspection of the halon fire suppression system is similar to the visual inspection of external surfaces as recommended by GALL AMP XI.M36.

SER Section 2.3.3.7 addresses the response to RAI-2.3.3.7-1. In its response dated August 30, 2006, the applicant added components of diesel fuel oil emergency transfer skid to Table 3.3.2-7, "Fuel Oil System Summary of Aging Management Evaluation."

The discussion column of Table 3.3-1, item 3.3.1-58 was revised to state that the Periodic Surveillance and Preventive Maintenance Program manages loss of material for steel components in the diesel fuel oil emergency transfer skid. The applicant also added the following activity to LRA Section B.1.24, "Preventive Surveillance and Preventive Maintenance":

Fuel oil system	Use visual or other NDE techniques to inspect diesel fuel oil emergency transfer skid steel components to manage internal and external loss of material.

The staff noted that the AMR result lines for components added to Table 3.3.2-7 refer to Note E. The staff reviewed the AMR result lines referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M36,"External Surfaces Monitoring," the applicant has proposed the Periodic Surveillance and Preventive Maintenance Program. The Periodic Surveillance and Preventive Maintenance Program uses visual or other NDE techniques to inspect diesel fuel oil emergency transfer skid steel components including the AMR result lines pointing to item 3.3.1-58. On the basis of periodic visual inspections, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program acceptable.

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 found that the applicant appropriately addressed the AEM as recommended by the GALL Report.

3.3.2.1.5 Increased Hardness, Shrinkage, and Loss of Strength Due to Weathering

The discussion column of LRA Table 3.3.1, item 3.3.1-61 states that this line item was not used in the auxiliary systems tables. Fire barrier seals are evaluated as structural components in LRA Section 3.5. Cracking and the change in material properties of elastomer seals are managed by the Fire Protection Program. In LRA Section 3.5, Table 3.5.2-6, "Bulk Commodities," on pages 3.5-82 and 3.5-83, referring to item 3.3.1-61, the applicant credits the Fire Protection Program and the Structures Monitoring Program. However, item 3.3.1-61 does not credit the Structures Monitoring Program.

The staff asked the applicant to clarify whether both programs are credited for managing aging effects for penetration seals as stated in LRA Table 3.5.2-6.

In its response dated July 19, 2006, the applicant revised LRA Table 3.5.2-6, pages 3.5-82 and 3.5-83, as follows:

Delete line items:

- Penetration sealant (fire rated, flood, radiation) // EN, FB, FLB, PB, SNS // Elastomer //Protected from weather // Cracking Change in material properties // Fire protection/Structures Monitoring // III.A6-12 (TP-7) // 3.5.1-44 // CSeismic joint filler // FB, SNS // Elastomer // Protected from weather // Cracking Change In material properties // Structures Monitoring, Fire Protection // VII.G-1 (A-19) //3.3.1-61// C

Add line items:

- Penetration sealant (fire rated) // EN, FB, PB, SNS // Elastomer // Protected from weather // Cracking Change in material properties // Fire Protection // VII.G-1(A-19) //3.3.1-61 // B

- Penetration sealant (flood, radiation) // EN, FLB, PB, SNS // Elastomer // Protected from weather// Cracking Change in material properties // Structures Monitoring // III.A6-12 (TP-7) // 3.5.1-44 // C

- Seismic isolation joint // FB, SNS // Elastomer // Protected from weather // Cracking Change in material properties // Fire protection // VII.G-1 (A-19) // 3.3.1-61 // D

- Seismic isolation joint // SNS // Elastomer // Protected from weather // Cracking Change in material properties // Structures monitoring // III.A6-12 (TP-7) // 3.5.1-44 // C

On the basis that the applicant has clarified the use of the Structures Monitoring Program and Fire Protection Program and referred to different Table 1 line items, the staff found the response acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.6 Loss of Material Due to General, Pitting, and Crevice Corrosion

The discussion column of LRA Table 3.3.1, item 3.3.1-64 states that this line item was not used. Loss of material of steel components exposed to fuel oil is addressed by other items, including LRA Table 3.3-1, items 3.3.1-20 and 3.3.1-32; however, the purpose of this line is to address the diesel-driven fire pump, the reason why the GALL Report recommended the Fire Protection Program. Neither LRA Table item 3.3.1-20 nor 3.3.1-32 credits the Fire Protection Program, only the Diesel Fuel Monitoring Program. During the audit and review, the staff asked the applicant to clarify whether it has a diesel-driven fire pump and, if so, where LRA Section 3.3 addresses it and whether the Fire Protection Program is credited.

In response the applicant stated that it has a diesel-driven fire pump with components addressed in LRA Table 3.3.2-7, including the fuel oil supply to the diesel-driven fire pump. The line item for carbon steel piping with a fuel oil internal environment in LRA Table 3.3.2-7 for the fuel supply line does not credit the Fire Protection Program. Although the programs credited in LRA Table 3.3.2-7 for the fuel supply line are acceptable alternatives for managing the effects of aging, to achieve consistency with the GALL Report, the LRA will be revised to credit the Fire Protection Program. LRA Table 3.3.2-7 will be revised to add an additional line item to credit the Fire Protection Program in addition to the Diesel Fuel Monitoring Program to manage the fuel supply line.

In a letter dated July 19, 2006, the applicant revised Table 3.3.2-7 to add a line item crediting the Fire Protection Program as follows:

> Piping // Pressure boundary // Carbon steel // Fuel oil (int) // Loss of material // Fire Protection and Diesel Fuel Monitoring// VII.G-21 (A-28) // 3.3.1-64 // B

The LRA Table 3.3.1, item 3.3.1-64, discussion column is revised as follows:

> Consistent with NUREG-1801. The Fire Protection Program and Diesel Fuel Monitoring Program manage loss of material for internal surfaces of steel piping (fire pump diesel fuel supply line) components exposed to fuel oil.

On the basis that the applicant credits the Fire Protection Program to manage aging effects of the fire pump diesel fuel supply line, the staff found the applicant's response acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.7 Loss of Material Due to General, Pitting, Crevice, and (for Drip Pans and Drain Lines) Microbiologically-Influenced Corrosion

The discussion column of LRA Table 3.3.1 item 3.3.1-72 states that loss of material of steel component internal surfaces exposed to a condensation environment is managed by the System Walkdown Program. During the audit and review, the staff noted that the AMR result line in LRA Table 3.3.2-3, RBCCW system, pointing to Table 3.1.1, item 3.1.1-72 refers to Note E. The only component to which this GALL Report line item applies is the heat exchanger housing.

The staff reviewed the AMR result lines referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," the applicant proposed the System Walkdown Program. The applicant stated that the System Walkdown Program manages loss of material for external carbon steel components by visual inspection of external surfaces. For systems where internal and external carbon steel surfaces are exposed to the same environment external surface conditions represent those of internal surfaces. Thus, loss of material on internal carbon steel surfaces is also managed by the System Walkdown Program.

During the audit and review, the staff asked the applicant to clarify how it had concluded that the internal surface of the heat exchanger is the same as the external in the RBCCW system.

In response the applicant stated that the internal components of the heat exchanger housing have the potential for exposure to a combination of low-temperature CCW and high-dewpoint indoor drywell air, which could cause (though not anticipated) condensation on the cooling coil that would collect in the bottom of the housing. Condensation was detected also on the uninsulated external surfaces of the heat exchanger housing due to housing surface temperatures downstream of the cooling coil less than or equal to the dewpoint of the air in the drywell. The applicant factored these environments conservatively even though the anticipated environment would be indoor air with no condensation because the cooling water temperature normally is maintained at approximately 80°F. The System Walkdown Program was credited because the anticipated environment for both internal and external surfaces would be the same in either case.

On the bases that the internal environment is the same as the external and because the System Walkdown Program is consistent with GALL AMP XI.M36, "External Surfaces Monitoring," which manages loss of material from internal surfaces for situations in which material and environmental conditions are the same for internal and external surfaces so external surface condition represents the internal, the staff found the applicant's use of the System Walkdown Program for aging management of this heat exchanger housing acceptable.

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 found that the applicant addressed the AEM adequately as recommended by the GALL Report.

3.3.2.1.8 Loss of Material Due to General and Pitting Corrosion; and Loss of Material Due to General, Pitting, and Crevice Corrosion

The discussion column of LRA Table 3.3.1, items 3.3.1-53 and 3.3.1-54 states that loss of material of steel and SS component internal surfaces exposed to a condensation environment in an IA system is managed by the Instrument Air Quality and One-Time Inspection programs. During the audit and review, the staff noted that the AMR result line in LRA Table 3.3.2-8, "Instrument Air System," pointing to Table 3.1.1, items 3.1.1-53 and 3.3.1-54 refer to Note E.

The staff reviewed the AMR result lines referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M24, "Compressed Air Monitoring," the applicant proposed the Instrument Air Quality and One-Time Inspection programs. GALL AMP XI.M24 recommends periodic monitoring and visual inspection of air quality for the presence of contaminants. The staff reviewed the plant-specific Instrument Air Quality Program and determined that the applicant performs periodic sampling at various system locations. Furthermore, the applicant has proposed a One-Time Inspection Program at susceptible locations to confirm that aging degradation has not occurred. On these bases, the staff found the applicant's use of the Instrument Air Quality and One-Time Inspection programs acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.9 Loss of Material Due to General, Pitting, and Crevice Corrosion

The discussion column of LRA Table 3.3.1, item 3.3.1-59 states that loss of material of steel heat exchanger tubes external surfaces exposed to an air-indoor uncontrolled environment in the security diesel system is managed by the Periodic Surveillance and Preventive Maintenance Program. During the audit and review, the staff noted that the AMR result line in LRA Table 3.3.2-6, "Security Diesel System," pointing to Table 3.1.1, item 3.1.1-59 refer to Note E.

The staff reviewed the AMR result lines referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M36, "External Surface Monitoring," the applicant proposed the Periodic Surveillance and Preventive Maintenance Program. GALL AMP XI.M3 recommends periodic visual inspections of external surfaces during system walkdowns for evidence of material loss. As the heat exchanger tube surface is not easily accessible during system walkdowns, the applicant credits the Periodic Surveillance and Preventive Maintenance Program, which uses visual or other NDE techniques to inspect representative samples of security diesel oil cooler, after-cooler, and radiator tubes to manage loss of material. On the basis of periodic visual inspections, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.10 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

The discussion column of LRA Table 3.3.1 item 3.3.1-68 states that loss of material of steel piping, piping components, and piping elements exposed to a raw water environment is managed by the Periodic Surveillance and Preventive Maintenance Program. During the audit and review, the staff noted that the AMR result line pointing to Table 3.1.1, item 3.1.1-68 refers to Note E.

The staff reviewed the AMR result line referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M27, "Fire Water System," the applicant proposed the Periodic Surveillance and Preventive Maintenance Program. The GALL Report line item is in the fire protection water system, and, therefore, the GALL Report recommends AMP XI.M27. The staff found that the applicant's fire protection water system uses not raw but treated water. The AMR result lines pointing to Table 3.1.1, item 3.3.1-68, are listed only in those systems in-scope for 10 CFR 54.4(a)(2) and are not in the fire protection water system. The Periodic Surveillance and Preventive Maintenance Program uses visual or other NDE techniques to inspect representative samples of nonsafety-related components affecting safety-related systems, including the AMR result lines pointing to item 3.3.1-68. On the basis of periodic visual inspections, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.11 Hardening and Loss of Strength Due to Elastomer Degradation; Loss of Material Due to Erosion

The discussion column of LRA Table 3.3.1, item 3.3.1-75 states that degradation of elastomer components exposed to a raw or untreated water environment is managed by the Periodic Surveillance and Preventive Maintenance Program. During the audit and review, the staff noted that the AMR result line pointing to Table 3.1.1, item 3.1.1-75 refers to Note E.

The staff reviewed the AMR result line referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the Periodic Surveillance and Preventive Maintenance Program. The GALL Report line item is in the open-cycle cooling water system and, therefore, the GALL Report recommends AMP XI.M20; however, the AMR result line pointing to Table 3.1.1, item 3.3.1-75, are listed only in the radwaste system in-scope for 10 CFR 54.4(a)(2) and are not in the open-cycle cooling water system. The Periodic Surveillance and Preventive Maintenance Program visually inspects and manually flexes a representative sample of the flex/expansion joints in the radwaste system to manage cracking and change in material properties. On the basis of periodic visual inspections and manual flexing, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.12 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion, Fouling, and Lining/Coating Degradation

The discussion column of LRA Table 3.3.1, item 3.3.1-76 states that loss of material of steel components exposed to a raw water environment in the screen wash system is managed by the Periodic Surveillance and Preventive Maintenance Program. During the audit and review, the staff noted that the AMR result line pointing to Table 3.1.1, item 3.1.1-76 refers to Note E.

The staff reviewed the AMR result lines referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the Periodic Surveillance and Preventive Maintenance Program. The GALL Report line item is in the open-cycle cooling water system and, therefore, the GALL Report recommends AMP XI.M20. However, the AMR result lines pointing to Table 3.1.1, item 3.3.1-76, are listed only in the screen wash system in-scope for

10 CFR 54.4(a)(2) and are not in the open-cycle cooling water system. The Periodic Surveillance and Preventive Maintenance Program uses visual or other NDE techniques to inspect representative samples of nonsafety-related components affecting safety-related systems, including the AMR result lines pointing to item 3.3.1-76. On the basis of periodic visual inspections, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.13 Loss of Material Due to Pitting and Crevice Corrosion

The discussion column of LRA Table 3.3.1, item 3.3.1-78 states that loss of material of nickel alloy components exposed to a raw water environment in the screen wash system is managed by the Periodic Surveillance and Preventive Maintenance Program. During the audit and review, the staff noted that the AMR result line pointing to Table 3.1.1, item 3.1.1-78 refers to Note E.

The staff reviewed the AMR result line referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the Periodic Surveillance and Preventive Maintenance Program. The GALL Report line item is in the open-cycle cooling water system and, therefore, the GALL Report recommends AMP XI.M20. However, the AMR result lines pointing to Table 3.1.1, item 3.3.1-78, are listed only in the screen wash system in-scope for 10 CFR 54.4(a)(2) and are not in the open-cycle cooling water system. The Periodic Surveillance and Preventive Maintenance Program uses visual or other NDE techniques to inspect representative samples of nonsafety-related components affecting safety-related systems, including the AMR result lines pointing to item 3.3.1-78. On the basis of periodic visual inspections, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.14 Loss of Material Due to Pitting and Crevice Corrosion and Fouling

The discussion column of LRA Table 3.3.1, item 3.3.1-79 states that loss of material of SS components exposed to a raw or untreated water environment in the screen wash, sanitary soiled waste, and vent; plumbing and drains; and radwaste systems is managed by the Periodic Surveillance and Preventive Maintenance and One-Time Inspection programs. During the audit and review, the staff noted that the AMR result line pointing to Table 3.1.1, item 3.1.1-79 refers to Note E.

The staff reviewed the AMR result line referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the Periodic Surveillance and Preventive Maintenance Program for the screen wash system and the One-Time Inspection Program for other systems. The GALL Report line item is in the open-cycle cooling water system and, therefore, the GALL Report recommends AMP XI.M20. However, the AMR result lines pointing to LRA Table 3.1.1, item 3.3.1-79, are listed only in systems in-scope for 10 CFR 54.4(a)(2) and are not in the open-cycle cooling water system. The Periodic Surveillance and Preventive Maintenance Program uses visual or other NDE techniques to inspect representative samples of nonsafety-related components affecting safety-related systems, including the AMR result lines pointing to item 3.3.1-79. The One-Time Inspection Program includes a one-time inspection activity to confirm that loss of material has not occurred or is so insignificant that no aging management is warranted. On the basis of periodic or one-time visual inspections, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program and One-Time Inspection Program acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.15 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

The discussion column of LRA Table 3.3.1, item 3.3.1-81 states that loss of material of copper alloy components exposed to a raw or untreated water environment in the nonsafety-related systems is managed by the Periodic Surveillance and Preventive Maintenance Program. During the audit and review, the staff noted that the AMR result line pointing to Table 3.1.1, item 3.1.1-81, refers to Note E.

The staff reviewed the AMR result line referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M20, "Open-Cycle Cooling Water System," the applicant proposed the Periodic Surveillance and Preventive Maintenance Program. The GALL Report line item is in the open-cycle cooling water system and, therefore, the GALL Report recommends AMP XI.M20. However, the AMR result lines pointing to LRA Table 3.1.1, item 3.3.1-81, are listed only in nonsafety-related systems in-scope for 10 CFR 54.4(a)(2) and are not in the open-cycle cooling water system. The Periodic Surveillance and Preventive Maintenance Program uses visual or other NDE techniques to inspect representative samples of nonsafety-related components affecting safety-related systems, including the AMR result lines pointing to item 3.3.1-81. On the basis of periodic visual inspections, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.16 Cracking Due to Stress Corrosion Cracking

The discussion column of LRA Table 3.3.1, item 3.3.1-38 states that cracking of SS RWCU system components exposed to treated water greater than 140°F is managed by the Water Chemistry Control – BWR and One-Time Inspection programs. During the audit and review, the staff noted that the AMR result lines pointing to Table 3.1.1, item 3.1.1-38, refer to Note E. The only components to which this GALL Report line item applies are included in-scope only under 10 CFR 54.4(a)(2).

The staff reviewed the AMR result line referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M7, "BWR Stress Corrosion Cracking," and AMP XI.M2, "Water Chemistry," the applicant proposed the Water Chemistry Control – BWR and One-Time Inspection programs. The discussion column states that none of these components are within the scope of the BWR Stress Corrosion Cracking Program. The Water Chemistry Control – BWR Program periodically samples the primary water in the RCS to maintain contaminants within prescribed levels, and the One-Time Inspection Program verifies the effectiveness of the Water Chemistry Program. On this basis, the staff found the applicant's use of the Water Chemistry Control – BWR and One-Time Inspection programs for aging management of these nonsafety-related components acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.17 Loss of Material Due to General Corrosion

During the audit and review, the staff noted that some AMR result lines pointing to LRA Section 3.2, "Engineered Safety Features Systems," Table 3.2.1, item 3.2.1-32 refer to Note E. The line item for steel piping and ducting components and internal surfaces exposed to an air-indoor uncontrolled environment was a reference on 26 component types. In addition, in a letter dated August 30, 2006, the applicant added four steel components exposed to an air-indoor internal environment in the fuel oil system that pointed to Table 3.2.1, item 3.2.1-32, and referred to Note E. The line item 3.2.1-32 was, therefore, a reference on 30 component types.

The staff reviewed the AMR result lines referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," the applicant proposed the System Walkdown Program for fifteen component types, the Fire Protection Program for three, and the Periodic Surveillance and Preventive Maintenance Program for twelve.

GALL AMP XI.M38 consists of periodic visual inspections of the internal surfaces of steel components not covered by other AMPs. The applicant stated that the System Walkdown Program manages loss of material for external carbon steel components by visual inspection of external surfaces. For systems with internal carbon steel surfaces exposed to the same environment as external surfaces, external surface conditions represent those of internal surfaces. Thus, loss of material on internal carbon steel surfaces is also managed by the System

Walkdown Program. Because the applicant uses an existing AMP with periodic plant system walkdowns and visual inspections to monitor for degradation and loss of material, the staff found the System Walkdown Program acceptable.

As to the three component types for which the applicant credited the Fire Protection Program, the staff found this program not credited in the Table 3.2.1, item 3.2.1-32 discussion column. The staff asked the applicant to clarify the discrepancy between the AMR result line items in LRA Table 3.3.2-x and Table 3.2.1, item 3.2.1-32, where the Fire Protection Program is credited in one table but not in the other.

In response the applicant stated that the System Walkdown Program is the more appropriate program for two of these component types, which are in the fire protection water system, and supplemented the LRA to revise the Table 3.3.2-x items. However, for one component type in the halon fire protection system the Fire Protection Program will inspect piping internal surfaces. The LRA will be supplemented to add the Fire Protection Program to the discussion column of Table 3.2.1, item 3.2.1-32.

In its response dated July 19, 2006, the applicant revised LRA Table 3.2.1, item 3.2.1-32 to add the Fire Protection Program to the list of programs managing internal surfaces of steel components exposed to air-indoor.

The staff reviewed the Fire Protection Program, which periodically inspects and tests the halon fire protection system. Because the applicant uses an existing AMP with visual inspection of internal surfaces, the staff found the applicant's use of the Fire Protection Program acceptable.

For the 12 component types in the emergency diesel, SBO diesel, fuel oil, and security diesel systems, the applicant credited the Periodic Surveillance and Preventive Maintenance Program, which uses visual or other NDE techniques to inspect representative system component samples. In the letter dated August 30, 2006, the applicant added the fuel oil components into the scope of the Periodic Surveillance and Preventive Maintenance Program. Because the applicant uses an existing AMP with visual inspection of internal surfaces, the staff found the applicant's use of the Periodic Surveillance and Preventive Maintenance Program acceptable.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.18 Reduction of Heat Transfer Due to Fouling

During the audit and review, the staff noted that some AMR result lines point to LRA Section 3.2, "Engineered Safety Features Systems," Table 3.2.1, item 3.2.1-9. These line items refer to Note E. This line item applies to copper alloy heat exchanger tubes exposed to a lubricating oil environment and was a reference on two component types.

During the audit and review, the staff noted that some AMR result lines point to LRA Section 3.4, "Steam and Power Conversion Systems," Table 3.4.1, item 3.4.1-10. These line items refer to Note E. This line item applies to steel heat exchanger tubes exposed to a lubricating oil environment. This line item was a reference on one component type.

The staff reviewed the AMR result lines referring to Note E and determined that the material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.M39, "Lubricating Oil Analysis," and AMP XI.M32, "One-Time Inspection," to verify the effectiveness of the lubricating oil analysis program, the applicant credited only the Oil Analysis Program.

The staff reviewed the Oil Analysis Program. The applicant stated that it depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the staff asked the applicant how it can make this statement if there has been no inspection.

In response the applicant added that during routine maintenance on components that contain lubricating oil, visual inspections of these components would detect degraded conditions that could be attributed to an ineffective Oil Analysis Program. The corrective action program has a low threshold for the detection of degraded conditions and would detect component corrosion or cracking. In plant-specific operating experience for the last five years no condition reports indicated an ineffective Oil Analysis Program or degraded component conditions like corrosion or cracking in a lubricating oil environment.

The applicant also stated that during corrective and PM activities in the past five years, many visual inspections of components containing lubricating oil would have detected degraded conditions like corrosion or cracking that could be attributed to an ineffective Oil Analysis Program. No condition reports of degraded component conditions like corrosion or cracking in a lubricating oil environment followed these inspections. These past inspections serve in lieu of a One-Time Inspection Program to confirm the effectiveness of the Oil Analysis Program.

The staff reviewed the applicant's documents, as documented in the audit and review report, and confirmed that there were no condition reports of degraded conditions of components in a lubricating oil environment. On the basis of periodic inspections of components in a lubricating oil environment during maintenance activities and operating experience reporting no degraded conditions, the staff determined that the Oil Analysis Program provides reasonable assurance that the effects of aging will be effectively managed through the period of extended operation. The staff reviewed the applicant's Oil Analysis Program and its evaluation is documented in the SER Section 3.0.3.2.13. The staff found the applicant's AMP acceptable for managing aging degradation.

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 found that the applicant addressed the AEM appropriately as recommended by the GALL Report.

3.3.2.1.19 *Loss of Material Due to General Pitting and Crevice Corrosion*

In LRA Table 3.3.2-14-27, "RWCU System," for steel heat exchanger shell in treated water internal environment, the applicant credited the Water Chemistry Control – Closed Cooling Water Program and referred to Table 3.3.1, item 3.3.1-17. However, item 3.3.1-17 addresses the Water Chemistry Control – BWR Program. During the audit and review, the staff asked the applicant to clarify this discrepancy.

In a letter dated July 19, 2006, the applicant revised in LRA Table 3.3.2-14-27 the last three columns for the carbon steel component type heat exchanger shell in treated water environment with an aging effect of loss of material to list VII.C2-14 (A-25), 3.3.1-47, and D. The Water Chemistry Control – Closed Cooling Water Program periodically samples the reactor building closed cooling water to maintain contaminants within prescribed levels, and the One-Time Inspection Program verifies the effectiveness of the Water Chemistry Program.

The staff reviewed LRA Table 3.3.1, item 3.3.1-47 and found the applicant's use of the Water Chemistry Control – Closed Cooling Water Program and One-Time Inspection Program adequately manage the loss of material due to general pitting and crevice corrosion. The staff's evaluation of these programs is documented in SER Sections 3.0.3.2.19 and 3.0.3.1.8, respectively. Therefore, the staff found the applicant's response acceptable.

In LRA Table 3.3.2-14-27, "RWCU System," for SS orifice in treated water internal environment, the applicant credited the Water Chemistry Control – Closed Cooling Water Program and referred to Table 3.3.1, item 3.3.1-17. However, item 3.3.1-17 addresses steel, not SS, components. During the audit and review, the staff asked the applicant to provide additional clarification.

In its response dated July 19, 2006, the applicant revised LRA Table 3.3.2-14-27, SS component type orifice in treated water environment with an aging effect of loss of material, to list Table 1, item 3.3.1-24.

The staff reviewed Line 3.3.1-24, confirmed that it addresses SS components, and found the applicant's response acceptable.

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 the associated aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with the AMRs in the GALL Report. 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 for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.3.2.2, the applicant's further evaluation of aging management, as recommended by the GALL Report, for the auxiliary systems components and provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- reduction of heat transfer due to fouling
- cracking due to SCC
- cracking due to SCC and cyclic loading

- hardening and loss of strength due to elastomer degradation
- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and 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

Staff Evaluation. For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the GALL Report and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's 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. Details of the staff's audit are documented in Audit and Review Report Section 3.3.2.2. The staff's review of the applicant's further evaluation follows:

3.3.2.2.1 Cumulative Fatigue Damage

The staff reviewed the AMR line items in Table 2s for the Auxiliary Systems in which fatigue-induced damage (to which the AMR line items refer as "fatigue - cracking") was shown as an AERM and in which the "TLAA - Metal Fatigue" was credited as the basis for management of the aging effect. This SER will refer to these AMR line items in Table 2s for the auxiliary systems as "AMRs on Non-Class 1 Fatigue" and to the relevant TLAA as the "TLAA on Metal Fatigue of Non-Class 1 Components."

The staff reviewed the applicant's TLAA on Metal Fatigue of Non-Class 1 Components in LRA Section 4.3.2. The staff determined that the applicant had indicated that all of the AMRs on Non-Class 1 Fatigue were within the scope of the ANSI B31.1 fatigue analysis in LRA Section 4.3.2; however, the staff determined that the AMRs on Non-Class 1 Fatigue did not indicate clearly which auxiliary system commodity groups were designed to B31.1 and which to a design code other than B31.1. Thus, the staff could not conclude that the TLAA on Metal Fatigue was appropriate for aging management for those Non-Class 1 commodity groups designed to a code other than B31.1. During the audit and review, the staff asked the applicant to respond to the following requests:

(1) Identify which design codes were applied to the non-piping commodity groups in the AMRs on Non-Class 1 Fatigue for the auxiliary systems

(2) Clarify whether the design codes required a metal fatigue analysis and summarize the type of metal fatigue analysis calculation required, if applicable

(3) Discuss how the metal fatigue analysis was acceptable in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii), if applicable

(4) Propose an acceptable AMP to manage fatigue-induced damage for the period of extended operation if the design code for the particular Non-Class 1 commodity group required no metal fatigue analysis

In a letter dated September 13, 2006, the applicant clarified that the following Auxiliary System components were not designed in accordance with B31.1:

- RBCCW heat exchanger tubes
- all non-piping components in the Nonsafety-Related Components Affecting Safety-Related System AMR Tables for the auxiliary systems (*i.e.*, components in LRA Tables 3.3.2-14-1 through 3.3.2-14-35)

The applicant clarified that the design codes for these components require no metal fatigue analyses and, therefore, proposed to use the One-Time Inspection Program to manage fatigue-induced damage for them in lieu of the TLAA on Metal Fatigue on Non-Class 1 Components.

The applicant's One-Time Inspection Program determines whether a specific aging effect of concern occurs in components with no plant-specific operating experience with the aging effect. The applicant has not indicated in LRA Tables 3.3.2-14-1 through 3.3.2-14-35 any relevant operating experience with fatigue-induced damage in auxiliary system nonpiping components. GALL AMP XI.M32, "One-Time Inspection," states that either an enhanced VT-1 (EVT-1) visual examination or volumetric examination techniques (*i.e.*, either ultrasonic or radiographic techniques) must be used for detection of component cracking.

The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.8. The staff concluded that the applicant's One-time Inspection Program is consistent with GALL AMP XI.M32 and acceptable for implementation. Therefore, the staff concludes that it is appropriate to credit the One-Time Inspection Program for these components by either an EVT-1 or volumetric examination technique to determine whether fatigue-induced damage is an AERM for the period of extended operation.

For the remaining AMR line items on Non-Class 1 Fatigue of auxiliary systems, the applicant confirmed that the design code for the components in the AMRs is B31.1 and that the TLAA on Metal Fatigue is credited to manage fatigue-induced damage in these components. Therefore, the staff concludes that use of the TLAA on Metal Fatigue of Non-Class 1 Components as the basis for managing fatigue-induced damage in these components is valid and acceptable because (1) these components are designed to B31.1, (2) B31.1 includes a metal fatigue analysis methodology for B31.1-designed components, and (3) LRA Section 4.3.2 includes a B31.1-based fatigue assessment for these components. The staff's evaluation of the TLAA on Metal Fatigue of Non-Class 1 Components to manage fatigue-induced damage in these components is in SER Section 4.3.2.2.

3.3.2.2.2 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.3.2.2.2 against the criteria in SRP-LR Section 3.3.2.2.2.

LRA Section 3.3.2.2.2 states that reduction of heat transfer due to fouling may occur in SS heat exchanger tubes exposed to treated water; however, heat transfer is not a license renewal intended function for any of the auxiliary system heat exchangers with SS tubes exposed to treated water. Therefore, this item is not applicable.

SRP-LR Section 3.3.2.2.2 states that reduction of heat transfer due to fouling may occur in SS heat exchanger tubes exposed to treated water. However, heat transfer is not a license renewal intended function for any of the auxiliary system heat exchangers with SS tubes exposed to treated water.

On the basis that there are no SS heat exchangers in the auxiliary systems with intended functions of heat transfer, the staff found this aging effect not applicable to this component type.

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.3.2.2.3 against the following SRP-LR Section 3.3.2.2.3 criteria:

(1) LRA Section 3.3.2.2.3 states that cracking due to SCC can occur in the SS piping, piping components, and piping elements of BWR SLC systems exposed to sodium pentaborate solution greater than 140°F. At PNPS the sodium pentaborate solution in the SLC system does not exceed 140°F. Therefore, cracking due to SCC is not an AERM for the SLC system. This item is not applicable.

    SRP-LR Section 3.3.2.2.3 states that cracking due to SCC may occur in the SS piping, piping components, and piping elements of the BWR SLC system that are exposed to sodium pentaborate solution greater than 60 °C (>140 °F). The existing AMP monitors and controls water chemistry to manage the aging effects of cracking due to SCC. However, high concentrations of impurities at crevices and locations with 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 does not occur. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that SCC does not occur and that component intended functions will be maintained during the period of extended operation.

    On the basis that there are no SS SLC system components with intended functions exposed to treated water greater than 140°F, the staff found this aging effect not applicable to this component type.

(2) LRA Section 3.3.2.2.3 states that cracking due to SCC in SS heat exchanger components exposed to treated water greater than 140°F is an AERM. There are no auxiliary system components at PNPS with SS cladding. For auxiliary systems these SS heat exchanger components are managed by the Water Chemistry Control – BWR Program, which

monitors parameters and contaminants so they remain within limits specified by the EPRI guidelines. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through visual and ultrasonic inspection of representative samples of components crediting this program for managing cracking.

SRP-LR Section 3.3.2.2.3 states that cracking due to SCC may occur in SS and stainless clad steel heat exchanger components exposed to treated water greater than 60 °C (>140 °F). The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff reviewed the program and determined that the applicant's plant chemistry program is based on an EPRI document for BWR water chemistry more recent than the EPRI document BWRVIP-29 (TR-103515) recommended by the GALL Report. The staff determined that use of a more recent issue of the BWRVIP water chemistry program document is acceptable. The discussion column of Table 3.3.1, item 5, states that the One-Time Inspection Program will verify the effectiveness of the water chemistry control program; however, for those line items in Table 3.3.2-X referring to this Table 3.3.1 line item, only the Water Chemistry Control – BWR Program is credited. During the audit and review, the staff asked why the One-Time Inspection Program was not credited in the Table 2 line items that refer to this Table 1 line item.

In a letter dated July 19, 2006, the applicant stated that the effectiveness of the Water Chemistry Control – Auxiliary Systems Program, Water Chemistry Control – BWR Program, and Water Chemistry Control – Closed Cooling Water Program is confirmed by the One-Time Inspection Program. For further clarification, LRA Appendix A for these three water chemistry control programs was revised to include the sentence: "The One-Time Inspection Program will confirm the effectiveness of the program."

On the basis of its review, the staff finds the applicant's response acceptable because the applicant is confirming the effectiveness of the water chemistry by using a one-time inspection.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.3.2 for further evaluation.

(3) LRA Section 3.3.2.2.3 states that cracking due to SCC in SS diesel engine exhaust piping exposed to diesel exhaust is an AERM. At PNPS, cracking of SS exhaust piping in the SBO diesel generator system is managed by the Periodic Surveillance and Preventive Maintenance Program by visual and other NDE techniques. These inspections will manage the aging effect of cracking so the component intended function will not be affected.

SRP-LR Section 3.3.2.2.3 states that cracking due to SCC MAY occur in SS diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff reviewed the Periodic Surveillance and Preventive Maintenance Program and determined that, by using visual or other NDE techniques to inspect representative samples of SBO diesel exhaust components, the aging effect of cracking will be adequately managed.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.3.2.2.3. For those line items that apply to LRA Section 3.3.2.2.3, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.4 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

LRA Section 3.3.2.2.4.1 states that cracking due to SCC and cyclic loading of SS non-regenerative heat exchanger components exposed to treated borated water evaluated under SRP-LR Section 3.3.2.2.4.1 applies to PWRs only. The staff finds acceptable the applicant's evaluation that this aging effect is not applicable to PNPS, a BWR plant.

LRA Section 3.3.2.2.4.2 states that cracking due to SCC and cyclic loading of SS regenerative heat exchanger components exposed to treated borated water evaluated under SRP-LR Section 3.3.2.2.4.1 applies to PWRs only. The staff finds acceptable the applicant's evaluation that this aging effect is not applicable to PNPS, a BWR plant.

LRA Section 3.3.2.2.4.3 states that cracking due to SCC and cyclic loading of SS high-pressure pumps in the chemical and volume control system evaluated under SRP-LR Section 3.3.2.2.4.3 applies to PWRs only. The staff finds acceptable the applicant's evaluation that this aging effect is not applicable to PNPS, a BWR plant.

3.3.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

The staff reviewed LRA Section 3.3.2.2.5 against the following SRP-LR Section 3.3.2.2.5 criteria:

(1) LRA Section 3.3.2.2.5 states that cracking and change in material properties due to elastomer degradation in elastomer duct flexible connections of the heating, ventilating, and air-conditioning (HVAC) systems exposed to air-indoor are AERMs. In its response dated August 30, 2006, the applicant added hoses on the diesel fuel oil emergency transfer skid in this section. These aging effects are managed by the Periodic Surveillance and Preventive Maintenance Program, which visually inspects and physically manipulates the flexible connections for aging that would affect intended functions. The Periodic Surveillance and Preventive Maintenance Program was revised via letter dated August 30, 2006, to include visual inspection and manipulation of fuel oil system hoses.

    SRP-LR Section 3.3.2.2.5 states that hardening and loss of strength due to elastomer degradation may occur in elastomer seals and components of heating and ventilation systems exposed to air - indoor uncontrolled (internal/external). The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff reviewed the Periodic Surveillance and Preventive Maintenance Program and determined that, visual inspections and manipulation of the flexible connections and hoses are at periodic intervals, the aging effect of hardening and loss of strength of elastomer components will be effectively managed.

(2) LRA Section 3.3.2.2.5 states that for auxiliary systems no credit is taken for any elastomer linings to prevent loss of material from underlying carbon steel material such that the material is identified as carbon steel for the AMR. This item is not applicable.

SRP-LR Section 3.3.2.2.5 states that hardening loss of strength due to elastomer degradation may occur in elastomer linings of the filters, valves, and ion exchangers in spent fuel pool cooling and cleanup systems (BWR and PWR) exposed to treated water or to treated borated water. The GALL Report recommends that a plant-specific AMP be evaluated to determine and assesses the qualified life of the linings in the environment to ensure that these aging effects are adequately managed.

As the applicant takes no credit for elastomer linings to prevent loss of material from the underlying carbon steel material, the staff agrees with the applicant that this line item is not applicable.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.3.2.2.5. For those line items that apply to LRA Section 3.3.2.2.5, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

The staff reviewed LRA Section 3.3.2.2.6 against the criteria in SRP-LR Section 3.3.2.2.6.

LRA Section 3.3.2.2.6 states that the loss of material and cracking are AERMs for boral spent fuel storage racks exposed to a treated water environment. These aging effects are managed by the Water Chemistry Control – BWR Program.

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 to treated borated water. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

LRA Section 3.3.2.2.6 states that the reduction of neutron-absorbing capacity is insignificant and requires no aging management. The potential for aging effects due to sustained irradiation of boral has been evaluated by the staff (BNL-NUREG-25582, dated January 1979; NUREG-1787, VC Summer SER, paragraph 3.5.2.4.2, p. 3-408) and determined to be insignificant. Plant-specific operating experience with the boral coupon inspected in 2000 is consistent with the staff's conclusion, and no AMP is required.

The staff reviewed the Water Chemistry Control – BWR Program, which monitors chlorides, sulfates, and dissolved oxygen to limit the contaminants. The staff determined that loss of material due to general corrosion will be adequately managed by the plant chemistry program. The applicant has stated that water chemistry control programs will be verified for effectiveness by the One-Time Inspection Program. The one-time inspection of boral coupon test specimens confirms that no significant aging degradation has occurred. The One-Time Inspection Program has provisions for increased inspection frequency based on first inspection results.

The staff determined that these AMPs are appropriate for the aging effects/mechanisms and that these programs effectively manage the effects of aging through the period of extended operation. The staff evaluated the Water Chemistry Control – BWR Program and the One-Time Inspection Program and its evaluation is documented in SER Sections 3.0.3.1.13 and 3.0.3.1.8, respectively.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.6 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.3.2.2.6. For those line items that apply to LRA Section 3.3.2.2.6, the staff determine, during the audit and review, 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).

3.3.2.2.7 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.7 against the following SRP-LR Section 3.3.2.2.7 criteria:

(1) LRA Section 3.3.2.2.7 states that steel piping and components in auxiliary systems exposed to lubricating oil are managed by the Oil Analysis Program, which periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. Plant-specific operating experience confirms the effectiveness of this program in maintaining contaminants within limits so corrosion does not affect component intended functions. PNPS is a BWR with an inert containment atmosphere and has no reactor coolant pump oil collection system.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements, including the tubing, valves, and tanks in the reactor coolant pump oil collection system, exposed to lubricating oil (as part of the fire protection system). The existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation. In addition, corrosion may occur at locations in the reactor coolant pump oil collection tank where water from wash downs may accumulate. Therefore, the effectiveness of the program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion, to include determining the thickness of the lower portion of the tank. A one-time inspection is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the Oil Analysis Program. The staff noted that the applicant depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. The staff asked the applicant how it can make this statement if there has been no inspection. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.1.18.

The staff found that, based on the program identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.7.1 for further evaluation.

(2) LRA Section 3.3.2.2.7 states that PNPS has no separate shutdown cooling system. Loss of material due to general, pitting, and crevice corrosion in carbon steel piping and components in other auxiliary systems exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components crediting this program, including those in areas of stagnant flow.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements in the BWR RWCU and shutdown cooling systems exposed to treated water. The existing AMP monitors and controls reactor water chemistry to manage the aging effects of loss of material from general, pitting, and crevice corrosion. However, high concentrations of impurities at crevices and locations with stagnant flow conditions could cause general, pitting, or crevice corrosion. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material from general, 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 does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the program and determined that the applicant's plant chemistry program is based on an EPRI document for BWR water chemistry more recent than the EPRI document BWRVIP-29 (TR-103515) recommended by the GALL Report. The staff determined that use of a more recent issue of the BWRVIP chemistry program document was acceptable. The discussion column of LRA Table 3.3.1-17, states that the One-Time Inspection Program will verify the effectiveness of the water chemistry control program; however, for those line items in Table 3.3.2-X referring to the Table 3.3.1, only the Water Chemistry Control – BWR Program is credited. During the audit and review, the staff asked why the One-Time Inspection Program was not credited in the Table 2 line items that refer to this Table 1 line item. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.2.3.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.7.2 for further evaluation.

(3) LRA Section 3.3.2.2.7 states that loss of material due to general (steel only) pitting and crevice corrosion for carbon steel and SS diesel exhaust piping and components exposed to diesel exhaust in the EDG, SBO diesel generator, and security diesel generator systems is managed by the Periodic Surveillance and Preventive Maintenance Program, which uses visual and other NDE techniques. Carbon steel diesel exhaust piping and components in the fire protection system are managed by the Fire Protection Program. The Fire Protection Program uses visual inspections of diesel exhaust piping and components to manage loss of material. These inspections in the Periodic Surveillance and Preventive Maintenance and Fire Protection programs will manage the aging effect of loss of material so component intended functions will not be affected.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general (steel only) pitting and crevice corrosion may occur in steel and SS diesel exhaust piping, piping components, and piping elements exposed to diesel exhaust. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff reviewed the Periodic Surveillance and Preventive Maintenance Program and determined that, as visual or other NDE techniques inspect representative samples of EDG, SBO diesel generator, and security diesel generator exhaust components, the aging effect of loss of material will be adequately managed.

The staff reviewed the Fire Protection Program and determined that the program description does not include nor has it been enhanced to include these components. During the audit and review, the staff asked the applicant to clarify how the Fire Protection Program will manage the aging effects for these components.

In response the applicant stated that procedures will be enhanced to verify that the diesel engine does not exhibit signs of degradation like exhaust gas leakage while running. Through monitoring and trending of performance data under the Fire Protection Program, loss of material for the diesel fire pump exhaust subsystem components will be detected and corrected through the corrective action program. As described in the Fire Protection Program, observation of degraded performance was followed by corrective actions, including engine replacement in 2002, before loss of intended function. Consequently, continued implementation of the Fire Protection Program reasonably assures management of aging effects for the diesel fire pump exhaust subsystem. In addition, the applicant stated that it will inspect, test, and maintain fire pumps in accordance with NFPA 25 and would detect the presence of aging effects in the exhaust system before loss of intended function.

The staff reviewed the response and found that the applicant manages the aging effects by verifying no leakage. The staff determined that verifying no leakage is not an adequate because it implies a through-wall leakage. The staff asked the applicant to justify how the aging effect is managed if it is a through-wall leakage.

The applicant stated that enhancements will be made to the Fire Protection Program to credit existing or implement new preventive maintenance tasks for the fire pump diesel so all aging effects shown in LRA Table 3.3.2-9 line items that apply to the fire pump diesel components are adequately managed and intended functions are maintained without the detection of leakage credited as management of an aging effect.

In a letter dated July 19, 2006, the applicant expanded Commitment No. 7 revising LRA Section A.2.1.13 to clarify inspection of the diesel-driven fire pump as follows:

> The diesel-driven fire pump inspection requires that the pump be periodically tested and system components internally inspected to ensure that the fuel supply line and engine support systems can perform their intended function.

LRA Section B.1.13.1 is revised with the following enhancement:

Table 3.3.2.2-7 Enhancement of LRA Section B.1.31.1

Attributes Affected	Enhancements
3. Parameters Monitored/Inspected 6. Acceptance Criteria	Procedures will be enhanced to clarify that at least once every five years, the diesel-driven fire pump engine is inspected for evidence of corrosion to manage loss of material in carbon steel and gray cast iron components including the intake air, exhaust, jacket water, and lube oil subsystems. The jacket water heat exchanger is inspected for evidence of fouling on the tubes. Also, the engine exhaust piping and silencer are inspected for evidence of cracking.

On the basis that the applicant credits periodic visual inspection in lieu of monitoring for leakage to manage aging effects, the staff found the enhancement acceptable.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.7.3 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.3.2.2.7. For those line items that apply to LRA Section 3.3.2.2.7, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.8 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.3.2.2.8 against the criteria in SRP-LR Section 3.3.2.2.8.

LRA Section 3.3.2.2.8 states that loss of material due to general, pitting, and crevice corrosion and MIC for carbon steel (with or without coating or wrapping) piping and components buried in soil in the SSW, fuel oil, and fire protection-water systems is managed by the Buried Piping and Tanks Inspection Program, which will include (a) preventive measures to mitigate corrosion and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried carbon steel components. Buried components will be inspected when excavated during maintenance. There will be an inspection within the first 10 years of the period of extended operation unless an opportunistic inspection occurs within this 10-year period. This program will manage the aging effect of loss of material so component intended functions will not be affected.

SRP-LR Section 3.3.2.2.8 states that loss of material due to general, pitting, crevice corrosion, and MIC may occur in steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material does not occur.

The staff reviewed the Buried Piping and Tanks Inspection Program which is consistent with GALL AMP XI.M34. The staff's evaluation of the Buried Piping and Tanks Inspection Program is documented in SER Section 3.0.3.2.1. On the basis of periodic inspections, including *opportunistic inspections on buried piping, the staff determined that the Buried Piping and Tanks* Inspection Program will adequately manage the aging effects through the period of extended operation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.3.2.2.8. For those line items that apply to LRA Section 3.3.2.2.8, 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).

3.3.2.2.9 Loss of Material Due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion and Fouling

The staff reviewed LRA Section 3.3.2.2.9 against the following SRP-LR Section 3.3.2.2.9 criteria:

(1) LRA Section 3.3.2.2.9 states that fouling is not an AERM for the fuel oil system. Loss of material due to general, pitting, crevice, and MIC for carbon steel piping and components exposed to fuel oil is an AERM, and these components are managed by the Diesel Fuel Monitoring Program, which samples and monitors fuel oil quality so it remains within the limits specified by the ASTM standards. Maintaining parameters within limits ensures that significant loss of material will not occur. Ultrasonic inspections of storage tank bottoms

where water and contaminants accumulate will confirm the effectiveness of the Diesel Fuel Monitoring Program. In addition, plant-specific operating experience confirms the effectiveness of this program in maintaining fuel oil quality within limits so loss of material does not affect component intended functions.

SRP-LR Section 3.3.2.2.9 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 existing AMP relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion or fouling. Corrosion or fouling may occur at locations where contaminants accumulate. The effectiveness of the fuel oil chemistry control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, crevice, MIC, and fouling to verify the effectiveness of the fuel oil chemistry program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the Diesel Fuel Monitoring Program, which samples and monitors fuel oil quality. In lieu of the One-Time Inspection Program to verify effectiveness, the applicant uses periodic UT inspections of tank bottoms, which is where corrosion is likely to occur due to water accumulation, to verify effectiveness. As the most susceptible location will be inspected for loss of material, the staff determined that UT inspection of storage tank bottoms is an acceptable method for verifying the effectiveness of the Diesel Fuel Monitoring Program.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.9.1 for further evaluation.

(2) LRA Section 3.3.2.2.9 states that the loss of material due to general, pitting, crevice, and MIC and fouling for carbon steel heat exchanger components exposed to lubricating oil is an AERM in the auxiliary systems managed by the Oil Analysis Program, which periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion or fouling. Plant-specific operating experience confirms the effectiveness of this program in maintaining contaminants within limits so corrosion and fouling does not affect component intended functions.

SRP-LR Section 3.3.2.2.9 states that loss of material due to general, pitting, crevice, MIC, and fouling may occur in steel heat exchanger components exposed to lubricating oil. The existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The applicant stated that it depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the staff asked the applicant how it can make this statement if there has been no inspection. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.1.18.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.9.2 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.3.2.2.9. For those line items that apply to LRA Section 3.3.2.2.9, the staff determines that the applicant 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).

3.3.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.10 against the following SRP-LR Section 3.3.2.2.10 criteria:

(1) LRA Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in BWR and PWR steel piping with elastomer lining or SS cladding exposed to treated water and treated borated water if the cladding or lining is degraded. For the auxiliary systems no credit is taken for any elastomer linings or SS cladding to prevent loss of material from the underlying carbon steel material as carbon steel for the AMR. This item is not applicable.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in BWR and PWR steel piping with elastomer lining or SS cladding that are exposed to treated water and treated borated water if the cladding or lining is degraded. The existing AMP monitors and controls 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 with stagnant flow conditions could cause pitting, or crevice corrosion. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

As the applicant takes no credit for elastomer linings or SS cladding to prevent loss of material from the underlying carbon steel material, the staff concurs with the applicant that this line item is not applicable.

(2) LRA Section 3.3.2.2.10 states that in the auxiliary systems there are no aluminum components exposed to treated water. The loss of material due to pitting and crevice corrosion for SS piping and components and for SS heat exchanger components exposed to treated water in the auxiliary systems is managed by the Water Chemistry Control –

BWR Program. The effectiveness of the program will be confirmed by the One-Time Inspection Program through inspection of representative samples of components crediting this program, including those in susceptible locations like areas of stagnant flow.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in SS and aluminum piping, piping components, piping elements, and for SS and steel with SS cladding heat exchanger components exposed to treated water. The existing AMP monitors and controls 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 with stagnant flow conditions could cause pitting, or crevice corrosion. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the program and determined that the applicant's plant chemistry program exceptions were nontechnical; the program is based on an EPRI document for BWR water chemistry more recent than the EPRI document BWRVIP-29 (TR-103515) recommended by the GALL Report. The staff determined that use of a more recent issue of the BWRVIP water chemistry program document was acceptable. The discussion column of Table 3.3.1, items 23 and 24 states that the One-Time Inspection Program will verify the effectiveness of the water chemistry control program. However, for those line items in Table 3.3.2-X referring to this Table 3.3.1 line item, only the Water Chemistry Control – BWR Program is credited. To resolve the discrepancy the staff asked why the One-Time Inspection Program was not credited in the Table 2 line items that refer to this Table 1 line item. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.2.3.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.2 for further evaluation.

(3) LRA Section 3.3.2.2.10 states that the loss of material due to pitting and crevice corrosion for copper alloy components exposed to condensation (external) in the HVAC and other auxiliary systems is managed by the System Walkdown and Periodic Surveillance and Preventive Maintenance programs. Both programs include periodic visual inspections, and the Periodic Surveillance and Preventive Maintenance Program includes other NDE techniques to manage loss of component material. These inspections will manage the aging effect of loss of material so component intended functions will not be affected.

SRP-LR Section 3.3.2.2.10 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 these aging effects are adequately managed.

The staff reviewed the Periodic Surveillance and Preventive Maintenance Program, which states that, for the RBCCW system, visual or other NDE techniques inspect representative samples of the in-scope RBCCW copper alloy cooling coils to manage loss of material. The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. On the basis of its review, the staff found that, with the heat exchanger tubes inspected periodically, the aging effect of loss of copper alloy material greater than 15 percent zinc in heat exchanger tubes exposed to an external environment of condensation will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

The staff reviewed the System Walkdown Program, which states that this program inspects external surfaces of components subject to AMR. The staff's evaluation of the System Walkdown Program is documented in SER Section 3.0.3.1.11. This program is consistent with GALL AMP XI.M36, "External Surfaces Monitoring Program." On the basis of its review, the staff found that the aging effect of loss of material of copper alloy components exposed to an external environment of condensation will be effectively managed by the System Walkdown Program.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.3 for further evaluation.

(4) LRA Section 3.3.2.2.10 states that a loss of material due to pitting and crevice corrosion for copper alloy components exposed to lubricating oil in auxiliary systems is managed by the Oil Analysis Program, which periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. Plant-specific operating experience confirms the effectiveness of this program in maintaining contaminants within limits so corrosion does not affect component intended functions.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The applicant stated that it depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the staff asked the applicant how it can make this statement if there has been no inspection. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.1.18.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.4 for further evaluation.

(5) LRA Section 3.3.2.2.10 states that the loss of material due to pitting and crevice corrosion may occur in HVAC aluminum piping, piping components, and piping elements and SS ducting and components exposed to condensation. At PNPS, there are no aluminum components or SS ducting exposed to condensation in the HVAC systems. However, this item can be applied to SS components exposed to condensation, both internal and external, in other systems. The System Walkdown Program and the Periodic Surveillance and Preventive Maintenance Program will manage loss of material in SS components exposed externally and internally, respectively, to condensation. Both programs include a periodic visual inspection, and the Periodic Surveillance and Preventive Maintenance Program includes other NDE techniques to manage loss of material of the components.

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 SS ducting and components exposed to condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The SS component types to which LRA Section 3.3.2.2.10.5 applies are shown in Table 3.3.2-X, which refers to Table 3.3.1, item 3.3.1-27. Two of these component types are in the EDG system in an internal environment of untreated air. Footnote 303 to these components states that the untreated air environment is the equivalent of the GALL Report environment of condensation. The Periodic Surveillance and Preventive Maintenance Program will manage the aging effect for these two component types.

The staff reviewed the Periodic Surveillance and Preventive Maintenance Program, which states that for the EDG system visual or other NDE techniques inspect representative samples of in-scope EDG components to manage loss of material. On the basis of its review, the staff found that, because these components will be inspected periodically, the aging effect of loss of material of SS components exposed to an internal environment of condensation will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

The other SS component types are in various systems in external environments of condensation. The aging effect of loss of material of these components is managed by the System Walkdown Program. The staff reviewed the System Walkdown Program, which states that this program inspects external surfaces of components subject to AMR. This program is consistent with GALL AMP XI.M36, "External Surfaces Monitoring Program." On the basis of its review, the staff found that the aging effect of loss of material of SS components exposed to an external environment of condensation effectively managed by the System Walkdown Program.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.5 for further evaluation.

(6) LRA Section 3.3.2.2.10 states that the 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. At PNPS, there are no copper alloy components exposed to condensation in the fire protection systems. However, this item can be applied to copper alloy components exposed to internal condensation in other

systems. The Periodic Surveillance and Preventive Maintenance and One-Time Inspection programs will manage loss of material in copper alloy components exposed internally to untreated air, which is equivalent to condensation, through visual inspections or other NDE techniques.

SRP-LR Section 3.3.2.2.10 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 these aging effects are adequately managed.

The component types to which LRA Section 3.3.2.2.10.6 applies are shown in Table 3.3.2-X, which refers to Table 3.3.1, item 3.3.1-28. One type is in the EDG system in an internal environment of untreated air. Footnote 303 to this component states that the untreated air environment is the equivalent of the GALL Report environment of condensation. The Periodic Surveillance and Preventive Maintenance Program will manage the aging effect for this component type.

The staff reviewed the Periodic Surveillance and Preventive Maintenance Program, which states that, for the EDG system, visual or other NDE techniques inspect representative samples of in-scope EDG components to manage loss of material. On the basis of its review, the staff found that, because these components will be inspected periodically, the aging effect of loss of material of copper alloy components exposed to an internal environment of condensation will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

Four component types are in the IA system in an internal environment of condensation. The Instrument Air Quality Program will manage the aging effects for these components. The staff reviewed the Instrument Air Quality Program, which maintains IA supplied to components is free of water and significant contaminants to preserve an environment not conducive to loss of material. Dewpoint, particulate contamination, and hydrocarbon concentration are checked periodically to maintain the IA quality. The staff found that, because IA quality will be checked periodically, the aging effect of loss of material of copper alloy components exposed to an internal environment of condensation will be effectively managed by the Instrument Air Quality Program.

Three component types are in the compressed air system (CAS). These components are in-scope per 10 CFR 54.4(a)(2) for nonsafety-related components affecting safety-related systems. The One-Time Inspection Program will manage the aging effects for these components. The staff reviewed the new One-Time Inspection Program, which is consistent with the recommendations of GALL AMP XI.M32, "One-Time Inspection," and confirms the potential long incubation period for certain aging effects on SCs. LRA Section B.1.23 notes that for internal surfaces of CASs a one-time inspection will confirm that loss of material in a CAS has not occurred or is so insignificant that no AMP is warranted. The applicant also stated that, when a one-time inspection reveals evidence of an aging effect, routine evaluation of the inspection results will ascertain appropriate corrective actions. The staff determined that the One-Time Inspection Program was the only AMP used for CASS in treated water, SS, carbon steel and copper alloys in untreated air and carbon steel in indoor air The staff found that, because the One-Time Inspection

Program will visually inspect the internal surfaces before the period of extended operation, the aging effect of loss of material of these components in a CAS exposed to an internal environment of condensation will be adequately managed by the One-Time Inspection Program.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.6 for further evaluation.

(7) LRA Section 3.3.2.2.10 states that the loss of material due to pitting and crevice corrosion may occur in SS piping, piping components, and piping elements exposed to soil. At PNPS, there are no SS components exposed to soil in the auxiliary systems. This item is not applicable to the auxiliary systems.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in SS piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

As there are no SS components exposed to soil in the auxiliary systems, the staff concurs with the applicant that this line item is not applicable.

(8) LRA Section 3.3.2.2.10 states that the loss of material due to pitting and crevice corrosion for SS piping and SLC system components exposed to sodium pentaborate solution is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspection of representative samples of components crediting this program, including those in susceptible locations like areas of stagnant flow.

SRP-LR Section 3.3.2.2.10 states that loss of material due to pitting and crevice corrosion may occur in SS piping, piping components, and piping elements of the BWR SLC system that are exposed to sodium pentaborate solution. The existing AMP monitors and controls water chemistry to manage the aging effects of loss of material due to pitting and crevice corrosion. However, high concentrations of impurities at crevices and locations with stagnant flow conditions could cause loss of material due to pitting and crevice corrosion. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program be verified to ensure that this aging effect does not occur. 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 does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the program and determined that the applicant's plant chemistry program is based on an EPRI document more recent than the EPRI document BWRVIP-29 (TR-103515) recommended by the GALL Report. The staff determined that use of a more recent issue of the BWRVIP chemistry program document is acceptable. The discussion column of Table 3.3.1, item 30, states that the One-Time Inspection Program will verify the effectiveness of the water chemistry control program. However, for those Table 3.3.2-X line items referring to this Table 3.3.1 line item, only the Water Chemistry Control – BWR Program is credited. To resolve the discrepancy the staff asked why the One-Time Inspection Program was not credited in the Table 2 line items that refer to this Table 1 line item. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.2.3.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10.8 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.3.2.2.10. For those line items that apply to LRA Section 3.3.2.2.10, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.11 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion

The staff reviewed LRA Section 3.3.2.2.11 against the criteria in SRP-LR Section 3.3.2.2.11.

LRA Section 3.3.2.2.11 states that the loss of material due to pitting, crevice, and galvanic corrosion may occur in copper alloy piping and components exposed to treated water. There are no copper alloy components exposed to treated water in the auxiliary systems. However, this item can be applied to copper alloy components exposed to treated water in the HPCI and RCIC systems. The Water Chemistry Control – BWR Program will manage loss of material for these components. The effectiveness of the program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components crediting this program, including those in susceptible locations like areas of stagnant flow.

SRP-LR Section 3.3.2.2.11 states that loss of material due to pitting, crevice, and galvanic corrosion may occur in copper alloy piping, piping components, and piping elements exposed to treated water. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program be verified to ensure that this aging does not occur. 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 does not occur and that component intended functions will be maintained during the period of extended operation.

Copper alloy piping, piping components and piping elements are not exposed to treated water for any auxiliary system components; however, it is used in Section 3.2, "Engineered Safety Features Systems." The discussion column of Table 3.3.1, item 31, states that the One-Time Inspection Program will verify the effectiveness of the water chemistry control program. However, for those Table 3.2.2-X line items referring to this Table 3.3.1 line item, only the Water Chemistry Control – BWR Program is credited. During the audit and review, the staff asked why the One-Time Inspection Program was not credited in the Table 2 line items that refer to this Table 1 line item. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.2.3.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.11 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.3.2.2.11. For those line items that apply to LRA Section 3.3.2.2.11, the staff determines that these items are 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).

3.3.2.2.12 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.3.2.2.12 against the following SRP-LR Section 3.3.2.2.12 criteria:

(1) LRA Section 3.3.2.2.12 states that there are no aluminum components exposed to fuel oil in the auxiliary systems. The loss of material due to pitting, crevice, and MIC in SS and copper alloy piping and components exposed to fuel oil is an AERM and these components are managed by the Diesel Fuel Monitoring Program. This program samples and monitors fuel oil quality so it remains within the limits specified by the ASTM standards. Maintaining parameters within limits ensures that significant loss of material will not occur. Plant-specific operating experience confirms the effectiveness of this program in maintaining fuel oil quality within limits so loss of material will not affect intended functions of these SS and copper alloy components.

SRP-LR Section 3.3.2.2.12 states that loss of material due to pitting, crevice, and MIC may occur in SS, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil. The existing AMP 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 does not occur. 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 does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the Diesel Fuel Monitoring Program, which samples and monitors fuel oil quality. In lieu of the One-Time Inspection Program to verify effectiveness, the applicant uses periodic UT inspections of tank bottoms, where corrosion is likely to occur due to any water accumulation, to verify effectiveness. As the most susceptible location will be inspected for loss of material, the staff determined that UT inspection of storage tank bottoms is an acceptable method for verifying the effectiveness of the Diesel Fuel Monitoring Program.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.12.2 for further evaluation.

(2) LRA Section 3.3.2.2.12 states that a loss of material due to pitting, crevice, and MIC in SS piping and components exposed to lubricating oil is managed by the Oil Analysis Program, which periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion.

Plant-specific operating experience confirms the effectiveness of this program in maintaining contaminants within limits so corrosion does not affect component intended functions.

SRP-LR Section 3.3.2.2.12 states that loss of material due to pitting, crevice, and MIC may occur in SS piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The applicant stated that it depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the staff asked the applicant how it can make this statement if there has been no inspection. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.1.18.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.3.2.2.12.2 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.3.2.2.12. For those line items that apply to LRA Section 3.3.2.2.12, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.13 Loss of Material Due to Wear

The staff reviewed LRA Section 3.3.2.2.13 against the criteria in SRP-LR Section 3.3.2.2.13.

LRA Section 3.3.2.2.13 states that a loss of material due to wear may occur in the elastomer seals and components exposed to air-indoor uncontrolled (internal or external). Wear is the removal of surface layers due to relative motion between two surfaces. In the auxiliary systems, this specific aging effect for elastomers is not applicable based on operating experience. Where the aging effects of change in material properties and cracking are detected for elastomer components, they are managed by the Periodic Surveillance and Preventive Maintenance Program. This item is not applicable to auxiliary systems.

SRP-LR Section 3.3.2.2.13 states that loss of material due to wear may occur in the elastomer seals and components exposed to air indoor uncontrolled (internal or external). The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

As there are no elastomer components with wear as an aging effect, the staff found this aging effect not applicable.

3.3.2.2.14 Loss of Material Due to Cladding Breach

The staff noted that the applicant did not address loss of material due to cladding breach for steel charging pump casings with SS cladding exposed to treated borated water evaluated under SRP-LR Section 3.3.2.2.14 applicable to PWR plants. The staff determines that this further evaluation is not applicable to PNPS, a BWR plant.

3.3.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

The staff's evaluation of the applicant's QA program for safety-related and nonsafety-related components is in SER Section 3.0.4.

3.3.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.3.2-1 through 3.3.2-13, 3.3.2-14- 2, 3.3.2-14-6, 3.3.2.14-8, 3.3.2.1-14-12 through 3.3.2-14-15, 3.3.2-14-19 through 3.3.2-14-24, 3.3.2-14-26, 3.3.2-14-27, and 3.3.2-14-29 through 3.3.2-14-34, 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 3.3.2-13 and Tables 3.3.2-14-1 through 3.3.2-14-35, the applicant indicated, via notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information 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.

Staff Evaluation. 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.

Aging Effects/Mechanisms in Table 3.3.1 Not Applicable to PNPS. The staff reviewed LRA Table 3.3.1, which summarizes aging management evaluations for the auxiliary systems evaluated in the GALL Report.

The LRA Table 3.3.1-39, discussion column states that cracking of SS BWR spent fuel storage racks exposed to treated water greater than 140°F due to SCC is not applicable because there are no SS spent fuel storage components with intended functions exposed to treated water greater than 140°F.

On the basis that there are no SS spent fuel storage components with intended functions exposed to treated water greater than 140°F, the staff found this aging effect not applicable to this component type.

The LRA Table 3.3.1-41, discussion column states that cracking of high-strength steel closure bolting exposed to air with steam or water leakage due to cyclic loading and SCC is not applicable because high-strength steel closure bolting is not used in auxiliary systems.

On the basis that high-strength steel closure bolting is not used in auxiliary systems, the staff found this aging effect not applicable to this component type.

The LRA Table 3.3.1-62, discussion column states that loss of material of aluminum piping, piping components, and piping elements exposed to raw water due to pitting and crevice corrosion is not applicable because there are no aluminum components with intended functions exposed to raw water in the auxiliary systems.

On the basis that there are no aluminum components with intended functions exposed to raw water in the auxiliary systems, the staff found this aging effect not applicable to this component type.

The LRA Table 3.3.1-77, discussion column states that loss of material of steel heat exchanger components exposed to raw water due to crevice, galvanic, and MIC and fouling is not applicable because steel heat exchanger components are not exposed to raw water in the auxiliary systems.

On the basis that steel heat exchanger components are not exposed to raw water in the auxiliary systems, the staff found this aging effect not applicable to this component type.

The LRA Table 3.3.1-80, discussion column states that loss of material of SS and copper alloy piping, piping components, and piping elements exposed to raw water due to pitting, crevice, and MIC is not applicable because this line applies to EDG system components. At PNPS, such components are not exposed to raw water.

On the basis that these components are not exposed to raw water the staff found this aging effect not applicable to this component type.

The LRA Table 3.3.1-98, discussion column states that aging effect-AMP combination "None-None" for steel, SS, and copper alloy piping, piping components, and piping elements exposed to dried air is not applicable. At PNPS dried (treated) air is maintained as an environment as a result of using the Instrument Air Quality Program, so it is possible that aging effects may occur without that program.

On the basis that these components are exposed to a dried air environment, the staff found this aging effect not applicable to these component type.

<u>Auxiliary Systems AMR Line Items With No Aging Effect (LRA Tables 3.3.2-1 through 3.3.2-13, 3.3.2-14- 2, 3.3.2-14-6, 3.3.2.14-8, 3.3.2.1-14-12 through 3.3.2-14-15, 3.3.2-14-19 through 3.3.2-14-24, 3.3.2-14-26, 3.3.2-14-27, and 3.3.2-14-29 through 3.3.2-14-34)</u>. LRA Tables 3.3.2-1 through 3.3.2-13, 3.3.2-14- 2, 3.3.2-14-6, 3.3.2.14-8, 3.3.2.1-14-12 through 3.3.2-14-15,

3.3.2-14-19 through 3.3.2-14-24, 3.3.2-14-26, 3.3.2-14-27, and 3.3.2-14-29 through 3.3.2-14-34 show line items with no aging effects found in the applicant's aging review process.

Specifically, components in which the applicant stated that no aging effects were found are fabricated from aluminum, glass, titanium, copper alloy greater than 15-percent zinc, copper alloy less than 15-percent zinc, plastic, fiberglass, and SS material exposed to condensation external, air-indoor internal, fuel oil, and various other environments.

The staff's discussions follow:

Aluminum in Air-Outdoor, Internal and External Environment. Aluminum has an excellent resistance to corrosion when exposed to a humid air (outdoor environment). The aluminum oxide film bonds strongly to its surface and, if damaged, reforms immediately in most environments. On a surface freshly abraded and then exposed to air, the oxide film is only 5 to 10 nanometers thick but highly effective in protecting the aluminum from corrosion. Therefore, aluminum exposed to an outdoor air environment has no applicable aging effect.

Glass in Condensation External Environment. Glass as a material is impervious to normal plant environments. 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 temperatures or during time periods of concern for extended operation.

Titanium in Condensation External Environment. The corrosion resistance of titanium is a result of the formation of a continuous, stable, highly-adherent protective oxide layer on the metal surface. The metal itself, very reactive with a high affinity for oxygen, reforms damage to this layer instantaneously. Therefore, titanium exposed to a condensation environment has no applicable aging effect.

Copper Alloy Greater Than 15-percent Zinc in Air-Indoor Internal Environment. Copper alloy greater than 15-percent zinc in air-indoor internal environment has no aging effect. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure as cited in *Metals Handbook*, Volume 13, "Corrosion" (American Society for Metals International, 1987).

Copper Alloy Less Than 15-Percent Zinc in Air-Indoor Internal Environment. Copper alloy less than 15-percent zinc in air-indoor internal environment has no aging effect. This conclusion is based on the fact that comprehensive tests conducted over a 20-year period under ASTM supervision have confirmed the suitability of copper and copper alloys for atmospheric exposure as cited in *Metals Handbook*, Volume 13, "Corrosion," (American Society for Metals International, 1987).

Plastic in Various Environments. The LRA uses "plastics" as a generic term. During the audit and review, the staff asked the applicant for the kinds of plastic materials used.

The applicant stated that piping codes JE, JF, JG, and HT are plastic or fiberglass. As in the PNPS specification for piping M-300, pipe class JE is fiberglass-reinforced plastic, piping code JF allows the use of polyvinyl chloride (PVC) piping, and Class HT piping is PVC. Per Note 3 on Drawing M211, M212 sheet 1, M273 sheet 3, some of the pipe code JG is PVC.

Some specific components also identified as plastics are not included in the piping class summary sheets and required component-specific reviews to identify the materials. For instance, the tank shown on M212 sheet 1 is identified on the drawing as a 55-gallon PVC drum, and some piping, like that on M273 sheet 3, is identified on the drawing as chlorinated polyvinyl chloride.

The fuel oil system, LRA Table 3.3.2-7, also shows a plastic filter housing on the SBO diesel fuel oil filter X-176. There are plastic bowls at the bottom of the filter housing collecting water and sediment. The exact type of plastic is not known but was selected for use by the original manufacturer in this application. In addition, like all the plastic materials described here, it is not exposed to direct sunlight and was designed for use with fuel oil. Therefore, as stated in the EPRI mechanical tools, none of these components is expected to experience aging effects that require management in the environments to which they are exposed.

PVC is unaffected by water, concentrated alkalies, nonoxidizing acids, oils, ozone, sunlight, or humidity changes.

Unlike metals, thermoplastics do not display corrosion rates. Rather than depend on an oxide layer for protection, they depend on chemical resistance to the environments to which they are exposed. The use of thermoplastics in a water environment is a design-driven criterion.

Fiberglass reinforced plastic is similarly impervious to normal plant environments. Chlorinated PVC is a stronger version of PVC not susceptible to age degradation in normal plant environments.

Therefore, based on industry experience and the assumption of proper design and application of the material, the staff concludes that aging of thermoplastics in treated water, raw water, and fuel oil environment is not an applicable aging effect. The staff's evaluation follows:

Fiberglass in Fuel Oil and Soil Environment. Fiberglass is used in a fuel oil and soil environment for its corrosive resistance. Fuel oil does not contain hydrofluoric acids or caustics; therefore, fiberglass in a fuel oil environment has no aging effect.

SS in an Air-Indoor Internal Environment. SSs are highly resistant to corrosion in dry atmospheres in the absence of corrosive species (which would be reflective of indoor uncontrolled air), as cited in *Metals Handbook*, Volumes 3 (p. 65) and 13 (p. 555) (Ninth Edition, American Society for Metals International, 1980 and 1987). Components are not subject to moisture in a dry air environment (and indoor uncontrolled air would have limited humidity and condensation). Therefore, SS in an indoor, uncontrolled air environment exhibits no aging effect, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

Fluoropolymer (Teflon) in Treated Air Internal Environment. Unlike metals, fluoropolymer (teflon) does not display corrosion rates. Rather than depend on an oxide layer for protection, it depends on chemical resistance to the environment to which it is exposed. Teflon is highly resistant to normal environments but degrades in a radiation environment; however, in a treated air internal environment like IA, teflon is impervious to aging effects. Therefore, fluoropolymer (teflon) in a treated air internal environment exhibits no aging effect, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

SS Braid/Teflon Liner in Air-Indoor Internal Environment. Unlike metals, teflon does not display corrosion rates. Rather than depend on an oxide layer for protection, it depends on chemical resistance to the environment to which it is exposed. It degrades in a radiation environment; however, in an air-indoor internal environment, teflon is impervious to aging effects. Therefore, teflon in an air-indoor internal environment exhibits no aging effect, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

SS Braid/Teflon Liner in Halon Internal Environment. Unlike metals, teflon does not display corrosion rates. Rather than depend on an oxide layer for protection, it depends on chemical resistance to the environment to which it is exposed. It degrades in a radiation environment; however, in an inert gas environment (*e.g.*, halon) teflon is impervious to aging effects. Therefore, teflon in a halon internal environment exhibits no aging effect, and the component or structure will remain capable of performing intended functions consistent with the CLB for the period of extended operation.

SS in an Air-Outdoor Environment. In some Table 2 items, the applicant stated "None-None" for aging effect-AMP combination for SS bolting in an air-outdoor environment; however, Tables 3.3.2-5 and 3.3.2-9 show loss of material as an aging effect for the same material-environment combination and credit the System Walkdown Program to manage this aging effect. The applicant was asked, during the audit and review, to clarify this discrepancy.

The applicant stated that the only table that did not show loss of material for SS bolting in an air-outdoor environment was Table 3.3.2-7 for the fuel oil system. Loss of material is an AERM that should have been shown for the SS bolting with an environment of air-outdoor.

In a letter dated July 19, 2006, the applicant revised the LRA Table 3.3.2-7 line item for component bolting, material SS, environment air-outdoor as follows:

> Bolting// Pressure boundary//stainless steel//air – outdoor (ext) // Loss of material //Bolting Integrity // // // G

The letter also included a writeup of its, "Bolting Integrity Program." The staff's evaluation of this program is documented in SER Section 3.0.3.2.20.

On the basis of its review, the staff found that condensation external, air-indoor internal, fuel oil, and various other environments on aluminum, glass, titanium, copper alloy greater than 15-percent zinc, copper alloy less than 15-percent zinc, plastic, fiberglass, and SS material will not cause aging of concern during the period of extended operation. Therefore, the staff concluded that there are no applicable AERMs for aluminum, glass, titanium, copper alloy greater than 15-percent zinc, copper alloy less than 15-percent zinc, plastic, fiberglass, and SS material components exposed to condensation external, air-indoor internal, fuel oil, and various other environments.

3.3.2.3.1 Standby Liquid Control System Summary of Aging Management Evaluation – LRA Table 3.3.2-1

The staff reviewed LRA Table 3.3.2-1, which summarizes the results of AMR evaluations for the SLC system component groups.

In LRA Table 3.3.2-1, the applicant proposed to manage loss of material of carbon steel-coated materials for tanks exposed to a sodium pentaborate internal environment using its, "Periodic Surveillance and Preventive Maintenance Program."

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program manage loss of material with SLC system UT or other NDE techniques verify remaining wall thickness to manage loss of material from internal surfaces of the carbon steel discharge accumulators (component group – tank). On the basis of its review, the staff found that, as the wall thickness will be measured periodically, the aging effect of loss of material of carbon steel-coated tank exposed to a sodium pentaborate internal environment will be adequately managed by the Periodic Surveillance and Preventive Maintenance Program. On this basis, the staff found management of loss of material in the SLC system acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results for material, environment, AERMs, 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 Salt Service Water Systems 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 SSW systems component groups.

In LRA Table 3.3.2-2, the applicant proposed to manage loss of material for nickel alloy material for bolting and valve body component types exposed to an external environment of condensation using, System Walkdown Program.

The staff evaluation of the System Walkdown Program is documented in SER Section 3.0.3.1.11. The System Walkdown Program inspects external surfaces of components subject to AMR. This program is consistent with GALL AMP XI.M36, "External Surfaces Monitoring Program." On the basis of its review, the staff found that the aging effect of loss of material of nickel alloy bolting and valve body exposed to an external environment of condensation will be adequately managed by the System Walkdown Program.

In LRA Table 3.3.2-2, the applicant proposed to manage loss of material for titanium material for piping and thermowell component types exposed to an environment of raw water using AMP B.1.28, "Service Water Integrity Program."

The staff review of the Service Water Integrity Program is documented in SER Section 3.0.3.2.16. The Service Water Integrity Program includes surveillance and control techniques (*e.g.*, visual inspection, eddy current testing) and other NDE techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the SSW system or SCs serviced by the SSW system. The staff reviewed the applicant's plant-specific operating experience and found that a number of components in 2004 revealed areas of erosion and corrosion on internal and external surfaces. During the inspections, the applicant also found that the lining in original carbon steel rubber-lined piping had deteriorated.

The applicant has since replaced the components with corrosion-resistant materials like titanium. The staff found the detection of degradation and appropriate corrective action are adequate assurance of program effectiveness.

On the basis of its review, including the applicant's plant-specific operating experience, the staff found that the aging effect of loss of material of titanium piping and thermowells exposed to an environment of raw water will be adequately managed by the Service Water Integrity Program.

In LRA Table 3.3.2-2, the applicant proposed to manage loss of material for copper alloy less than 15-percent zinc material for heat exchanger tube component types exposed to an external environment of treated water using Service Water Integrity Program.

The staff evaluation of the Service Water Integrity Program is documented in SER Section 3.0.3.2.16. The Service Water Integrity Program includes surveillance and control techniques (*e.g.*, visual inspection, eddy current testing) and other NDE techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the SSW system or SCs serviced by the SSW system. On the basis of its review, the staff found that the aging effect of loss of material of copper alloy less than 15 percent zinc heat exchanger tubes exposed to an external environment of treated water will be effectively managed by the Service Water Integrity Program.

In LRA Table 3.3.2-2, the applicant proposed to manage loss of material for titanium material for piping component types exposed to an external environment of soil using "Buried Piping and Tanks Inspection Program.

The staff's evaluation of the Buried Piping and Tanks Inspection Program is documented in SER Section 3.0.3.2.1. The new Buried Piping and Tanks Inspection Program inspects buried titanium components to manage the effects of loss of material due to corrosion. Buried components are inspected when excavated during maintenance. Although new, this program will be consistent with GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with an exception where the applicant may use methods like phased-array UT technology for wall thickness measurement of buried piping without excavation, as discussed in SER Section3.0.3.2.1. If an opportunistic inspection does not occur within a 10-year period, there will be a focused inspection. On this basis, the staff found that the aging effect of loss of material of titanium piping exposed to an external environment of soil will be adequately managed by the Buried Piping and Tanks Inspection Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Reactor Building Closed Cooling 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 RBCCW system component groups.

In LRA Table 3.3.2-3, the applicant proposed to manage loss of material for copper alloy less than 15 percent zinc material for heat exchanger tube component types exposed to an external environment of treated water using Service Water Integrity Program.

The staff's evaluation of the Service Water Integrity Program is documented in SER Section 3.0.3.2.16. The Service Water Integrity Program includes surveillance and control techniques (*e.g.*, visual inspection, eddy current testing) and other NDE techniques to manage aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in the SSW system or SCs serviced by the SSW system. On the basis of its review, the staff found that the aging effect of loss of material of copper alloy less than 15 percent zinc heat exchanger tubes exposed to an external environment of treated water will be effectively managed by the Service Water Integrity Program.

In LRA Table 3.3.2-3, the applicant proposed to manage loss of material for copper alloy greater than 15 percent zinc material for heat exchanger tube component types exposed to an external environment of air-indoor using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program manages loss of material of in-scope RBCCW copper alloy cooling coils by inspecting representative sample using visual or other NDE Techniques. On the basis of its review, the staff found that, because the heat exchanger tubes will be inspected periodically, the aging effect of loss of material of copper alloy greater than 15 percent zinc heat exchanger tubes exposed to an external environment of indoor air will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

In LRA Table 3.3.2-3, the applicant proposed to manage loss of material for copper alloy greater than 15-percent zinc material for heat exchanger tube component types exposed to an external environments of treated water and lube oil using Heat Exchanger Monitoring Program.

The staff's evaluation of the Heat Exchanger Monitoring Program is documented in SER Section 3.0.3.3.1. The Heat Exchanger Monitoring Program is a new plant-specific program that will inspect heat exchangers for degradation. Representative tubes within the heat exchanger samples will be eddy current-tested at a frequency determined by internal and external operating experience to detect effects of aging before loss of intended function. Along with each eddy current test, visual inspections on accessible heat exchanger heads, covers, and tube sheets will monitor surface condition for indications of loss of material. On the basis that the EDG lube oil coolers and the HPCI gland seal condenser included in the samples have the same material and environment as the heat exchangers in the RBCCW system, the staff found that the aging effect of loss of material of copper alloy greater than 15 percent zinc heat exchanger tubes exposed to an external environment of treated water and lube oil will be adequately managed by the Heat Exchanger Monitoring Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Emergency Diesel Generator 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 EDG system component groups.

In LRA Table 3.3.2-4, the applicant proposed to manage loss of material for copper alloy greater than 15 percent zinc material for heat exchanger tube component types exposed to an external environment of treated water and lube oil using Heat Exchanger Monitoring Program.

The staff's evaluation of the Heat Exchanger Monitoring Program is documented in SER Section 3.0.3.3.1. The Heat Exchanger Monitoring Program is a new plant-specific program that will inspect heat exchangers for degradation. Representative tubes within the heat exchanger samples will be eddy current-tested at a frequency determined by internal and external operating experience to detect effects of aging before loss of intended function. Along with each eddy current test, visual inspections on accessible heat exchanger heads, covers, and tube sheets will monitor surface conditions for indications of loss of material. On the basis that the EDG lube oil coolers are included in the sample population, the staff found that the aging effect of loss of material of copper alloy greater than 15 percent zinc heat exchanger tubes exposed to an external environment of treated water and lube oil will be adequately managed by the Heat Exchanger Monitoring Program.

In LRA Table 3.3.2-4, the applicant proposed to manage loss of material for copper alloy greater than 15 percent zinc material for heat exchanger tube component types exposed to an external environment of air-indoor and air-outdoor using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program manage loss of material and fouling by visually inspecting the EDG system, A/B EDG jacket water radiators. On the basis of its review, the staff found that, because the heat exchanger tubes will be inspected periodically, the aging effect of loss of material of copper alloy greater than 15 percent zinc heat exchanger tubes exposed to an external environment of indoor air and outdoor air will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

In LRA Table 3.3.2-4, the applicant proposed to manage fouling of copper alloy greater than 15 percent zinc material for heat exchanger tube component types exposed to an external environment of air-indoor and air-outdoor using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program manage fouling for heat exchanger tubes for EDG system and EDG surveillance tests. On the basis of its review, the staff found that, because the heat exchanger tubes will be tested periodically, the aging effect of fouling of copper alloy greater than 15 percent zinc heat exchanger tubes exposed to an external environment of indoor air and outdoor air will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

In LRA Table 3.3.2-4, the applicant proposed to manage cracking of SS material for strainer and valve body component types exposed to internal and external lube oil environments using Oil Analysis Program.

The staff's evaluation of the Oil Analysis Program is documented in SER Section 3.0.3.2.13. The Oil Analysis Program maintains oil systems free of contaminants (primarily water and particulates) to preserve an environment not conducive to loss of material, cracking, or fouling. Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results. The applicant stated that it depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the staff asked the applicant how it can make this statement if there has been no inspection. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.1.18.

In LRA Table 3.3.2-4, the applicant proposed to manage cracking due to fatigue of SS and carbon steel material for expansion joint, turbocharger housing, piping, and silencer component types exposed to an internal environment of exhaust gas and air-untreated using the metal fatigue TLAA.

The staff reviewed TLAA Section 4.3.2, "Non-Class 1 Fatigue," and its evaluation is documented in SER Section 4.3.2. However, it is not clear whether expansion joints and turbocharger housing are included in this section. During the audit and review, the staff asked the applicant to clarify whether these components are included in TLAA Section 4.3.2. The staff also asked the applicant to justify why Periodic Surveillance and Preventive Maintenance Program, is not credited for inspection of these components. The program description does include visual or NDE inspection of EDG exhaust components.

The applicant stated that the expansion joints and turbocharger were designed per B31.1 for a limited number of thermal cycles. The evaluation of fatigue therefore is addressed in Section 4.3.2. The applicant further stated that the SBO and security diesel generator exhaust systems are not designed to a code or standard for thermal cycles. Therefore, the Periodic Surveillance and Preventive Maintenance Program will manage the aging effect of cracking due to thermal fatigue. On this basis, the staff found the applicant's response acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Station Blackout Diesel 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 SBO diesel system component groups.

In LRA Table 3.3.2-5, the applicant proposed to manage loss of SS material for bolt component types exposed to an external environment of air-outdoor using System Walkdown Program.

The staff's evaluation of the System Walkdown Program is documented in SER Section 3.0.3.1.11. The System Walkdown Program inspects external surfaces of components subject to an AMR. This program is consistent with GALL AMP XI.M36, "External Surfaces Monitoring Program." On the basis of its review, the staff found that the aging effect of loss of material of SS bolting exposed to an external environment of air-outdoor will be effectively managed by the System Walkdown Program.

In LRA Table 3.3.2-5, the applicant proposed to manage fouling of copper alloy greater than 15 percent zinc material for heat exchanger tube component types exposed to an external environment of air-indoor using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program manages fouling for heat exchanger tubes for the SBO diesel generator system using SBO generator surveillance tests. On the basis of its review, the staff found that, because the heat exchanger tubes will be tested periodically, the aging effect of fouling of copper alloy greater than 15 percent zinc heat exchanger tubes exposed to an external environment of indoor air will be adequately managed by the Periodic Surveillance and Preventive Maintenance Program.

In LRA Table 3.3.2-5, the applicant proposed to manage fouling of aluminum material for heat exchanger fin component types and loss of material for SS radiator tubes exposed to an external environment of air-indoor or air-outdoor using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program manage loss of material and fouling by visually inspecting the SBO diesel generator system SBO jacket water radiators. On the basis of its review, the staff found that, because these components will be inspected periodically, the aging effect of fouling of aluminum heat exchanger fins and loss of material of radiator tubes exposed to an external environment of air-indoor and air-outdoor will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

In LRA Table 3.3.2-5, the applicant proposed to manage loss of material of carbon steel, SS, copper alloys less than and greater than 15 percent zinc for filter housing, lubricator housing, motor housing, piping, strainer housing, tank, tubing and valve body component types exposed to an internal environment of treated air using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program manage loss of material by inspecting representative samples of SBO diesel intake air, air start, and exhaust components, cracking, and fouling using visual or other NDE techniques.

On the basis of its review, the staff found that, because these components will be inspected periodically, the aging effect of loss of material of carbon steel, SS, copper alloys less than and greater than 15 percent zinc components exposed to an internal environment of treated air will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

In LRA Table 3.3.2-5, the applicant proposed to manage cracking due to fatigue of SS and carbon steel material for turbocharger housing, piping, and silencer component types exposed to an internal environment of exhaust gas using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program manages loss of material on internal and external surfaces, by inspecting a representative sample of SBO diesel intake air, air start, and exhaust components for cracking and fouling, using visual or other NDE techniques.

On the basis of its review, the staff found that, because these components will be inspected periodically, the aging effect of cracking of carbon steel, SS, copper alloys less than and greater than 15 percent zinc components exposed to an internal environment of exhaust gas will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

In LRA Table 3.3.2-5, the applicant proposed to manage cracking of SS material for strainer and tubing component types exposed to an internal environment of lube oil using Oil Analysis Program.

The staff's evaluation of the Oil Analysis Program is documented in SER Section 3.0.3.2.13. The Oil Analysis Program manages loss of material, cracking, or fouling by maintaining oil systems free of contaminants (primarily water and particulates) to preserve an environment not conducive to loss material. Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results. The applicant stated that it depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the staff asked the applicant how it can make this statement if there has been no inspection. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.1.18.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results for material, environment, AERMs, 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 Security Diesel 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 security diesel component groups.

In LRA Table 3.3.2-6, the applicant proposed to manage fouling of copper alloy greater than 15 percent zinc and carbon steel material for heat exchanger radiator and tube component types exposed to an external environment of air-indoor using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program manages fouling for heat exchanger tubes for the security diesel generator system using security diesel generator surveillance tests. On the basis of its review, the staff found that, because these components will be tested periodically, the aging effect of fouling of copper alloy greater than 15 percent zinc and carbon steel heat exchanger radiator and tubes exposed to an external environment of indoor air will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

In LRA Table 3.3.2-6, the applicant proposed to manage loss of material for carbon steel and copper alloy greater than 15 percent zinc heat exchanger radiator and tubes exposed to an external environment of air-indoor using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program description states that for the security diesel generator system visual inspections of security diesel jacket water radiators manage loss of material and fouling. On the basis of its review, the staff found that, because these components will be inspected periodically, the aging effect of loss of material of heat exchanger radiator and tubes exposed to an external environment of air-indoor and air-outdoor will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

In LRA Table 3.3.2-6, the applicant proposed to manage loss of carbon steel material for heat exchanger tube component types exposed to an external environment of lube oil using the Oil Analysis Program.

The staff's evaluation of the Oil Analysis Program is documented in SER Section 3.0.3.2.13. The Oil Analysis Program description states that the program maintains oil systems free of contaminants (primarily water and particulates) to preserve an environment not conducive to loss of material, cracking, or fouling. Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results. The applicant stated that it depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. The staff asked the applicant how it can make this statement if there has been no inspection. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.1.18.

In LRA Table 3.3.2-6, the applicant proposed to manage cracking due to fatigue of carbon steel and gray cast iron material for turbocharger housing, piping, and silencer component types exposed to an internal environment of exhaust gas using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program description states that visual or other NDE techniques inspect representative samples of SBO diesel intake air, air start, and exhaust components to manage loss of material, cracking, and fouling.

On the basis of its review, the staff found that, because these components will be inspected periodically, the aging effect of cracking of carbon steel and gray cast iron components exposed to an internal environment of exhaust gas will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Fuel Oil 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 fuel oil component groups. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.8 Instrument Air 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 IA system component groups. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.9 Fire Protection-Water 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 fire protection-water system component groups.

In LRA Table 3.3.2-9, the applicant proposed to manage loss of material and fouling of gray cast iron and copper alloy greater than15 percent zinc material for heat exchanger shell and tube and piping, pump casing, and tank component types exposed to an internal environment of treated water using the Fire Protection Program.

The staff's evaluation of the Fire Protection Program, is documented in SER Section 3.0.3.2.10. However, the Fire Protection Program description does not include nor has it been enhanced to include these components. The applicant was asked to clarify how the Fire Protection Program will manage these aging effects for these components.

In response, the applicant stated that, as stated in LRA Section B.1.13.1, procedures will be enhanced to verify whether the diesel engine exhibits signs of degradation while running. Included within the scope of this test are components with lube oil, fuel oil, treated water, and exhaust gas environments. Through monitoring and trending of performance data, specifically jacket cooling water, fouling and loss of material for the fire pump diesel jacket water heat exchanger will be detected and corrected through the corrective action program. On the basis that the applicant has indicated these components appropriately in the program writeup, the staff found the response acceptable.

In LRA Table 3.3.2-9, the applicant proposed to manage cracking due to fatigue of carbon steel material for piping, silencer, and turbocharger component types exposed to an internal environment of exhaust gas using the Fire Protection Program.

The staff's evaluation of the Fire Protection Program, is documented in SER Section 3.0.3.2.10. The "acceptance criteria" program element is enhanced to verify whether the diesel engine exhibits signs of degradation like exhaust gas leakage while running. The staff did not consider verifying for leakage an adequate AMP for managing cracking. Leakage implies a through-wall crack. The applicant was asked to justify how the aging effect of cracking is managed by verifying exhaust gas leakage. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.2.7.

In LRA Table 3.3.2.9, the applicant proposed to manage loss of material of carbon steel, gray cast iron, SS, copper alloy greater than 15 percent zinc and copper alloy less than 15 percent zinc material for hydrant, nozzle, orifice, piping, pump casing, strainer, strainer housing, tank, tubing, and valve body component types exposed to an internal environment of treated water using the Fire Water System Program.

The staff's evaluation of the Fire Water System Program is documented in SER Section 3.0.3.2.11. This program is consistent with GALL AMP XI.M27, "Fire Water System," with enhancements and an exception. On the basis of its review, the staff found that, because these components will be inspected periodically and tested, the aging effect of loss of material of carbon steel, gray cast iron, SS, copper alloy greater than 15 percent zinc and copper alloy less than 15 percent zinc components exposed to an internal environment of treated water will be effectively managed by the Fire Water System Program.

In LRA Table 3.3.2-9, the applicant proposed to manage cracking of SS material for strainer component types exposed to an external environment of lube oil using the Oil Analysis Program.

The staff's evaluation of the Oil Analysis Program is documented in SER Section 3.0.3.2.13. The Oil Analysis Program description states that the program maintains oil systems free of contaminants (primarily water and particulates) to preserve an environment not conducive to loss of material, cracking, or fouling. Sampling frequencies are based on vendor recommendations, accessibility during plant operation, equipment importance to plant operation, and previous test results. The applicant stated that it depends on plant-specific operating experience to verify the effectiveness of the Oil Analysis Program. The staff asked the applicant how it can make this statement if there has been no inspection. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.1.18.

In LRA Table 3.3.2-9, the applicant proposed to manage loss of material of SS material for bolt component types exposed to an external environment of air-outdoor using the System Walkdown Program.

The staff's evaluation of the System Walkdown Program is documented in SER Section 3.0.3.1.11. The System Walkdown Program description states that this program inspects external surfaces of components subject to an AMR. This program is consistent with GALL AMP XI.M36, "External Surfaces Monitoring Program." On the basis of its review, the staff found that the aging effect of loss of material of SS bolting exposed to an external environment of air-outdoor will be effectively managed by the System Walkdown Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Fire Protection-Halon 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 fire protection-halon system component groups. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.11 Heating, Ventilation and Air Conditioning Systems 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 HVAC systems component groups.

In LRA Table 3.3.2-11, the applicant proposed to manage fouling of copper alloy with greater than 15 percent zinc material for heat exchanger tube component types exposed to an external environment of condensation using the Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program description states that visual or other NDE techniques inspect the air side of heat exchanger copper alloy tubes to manage loss of material and fouling. On the basis of its review, the staff found that, because these components will be inspected periodically, the aging effect of fouling of copper alloy with greater than 15 percent zinc components exposed to an external environment of condensation will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Primary Containment Atmosphere Control Systems 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 primary containment atmosphere control system component groups. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.13 Fuel Pool Cooling and Fuel Handling and Storage Systems 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 fuel pool cooling and fuel handling and storage system component groups.

In LRA Table 3.3.2-13, the applicant proposed to manage cracking of aluminum/boron carbide material for neutron absorber (boral) component types exposed to an external environment of treated water using the Water Chemistry Control – BWR Program. Furthermore, in a letter dated

July 19, 2006, the applicant revised LRA Table 3.3.2-13, line items for the component type neutron absorber with aging effects "loss of material" and "cracking" to indicate that these aging effects are managed by the Water Chemistry Control – BWR Program. The line items will now use Note H, "Aging effect not in NUREG- 1801 for this component, material and environment combination."

The staff's evaluation of the Water Chemistry Control – BWR Program is documented in SER Section 3.0.3.1.13. This program is consistent with GALL AMP XI.M2, "Water Chemistry." On the basis of its review, the staff found that, because the water chemistry will be monitored periodically and controlled within established levels of contaminants, the aging effect of cracking of aluminum/boron carbide neutron absorber (boral) components exposed to an external environment of treated water will be effectively managed by the Water Chemistry Control – BWR Program. However, for Table 3.3.2-13 line items crediting the Water Chemistry Control – BWR Program the applicant did not indicate how it proposes to verify the effectiveness of the water chemistry control program. The staff asked the applicant to justify why a verification program was not credited. The applicant's response and the staff's evaluation are documented in SER Section 3.3.2.2.3.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Compressed Air System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-2

The staff reviewed LRA Table 3.3.2-14-2, which summarizes the results of AMR evaluations for the CAS nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.15 Control Rod Drive System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation – LRA Table 3.3.2-14-6

The staff reviewed LRA Table 3.3.2-14-6, which summarizes the results of AMR evaluations for the CRD system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.16 Emergency Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-8

The staff reviewed LRA Table 3.3.2-14-8, which summarizes the results of AMR evaluations for the EDG system nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-8, the applicant proposed to manage cracking and loss of SS material for piping and valve body component types exposed to an internal environment of untreated air using the One-Time Inspection Program.

The staff's evaluation of the One-Time Inspection Program is documented in SER Section 3.0.3.1.8. The new One-Time Inspection Program will be consistent with GALL AMP XI.M32, "One-Time Inspection." The program description states that, for internal surfaces and EDG system components containing untreated air, one-time inspection activity will confirm that cracking and loss of material have not occurred or are so insignificant that no AMP is warranted. Normally a one-time inspection by itself may not be adequate for managing aging effects; however, SS in an untreated air environment may exhibit an insignificant loss of material due to the moisture in the air, and the one-time inspection would confirm whether any aging has occurred. Similarly, for cracking to occur in SS, moisture and a temperature greater than 140°F must be present. Neither of these conditions is present in an untreated air environment, but the applicant has assumed conservatively that cracking may occur. Again, a one-time inspection would confirm whether there is any cracking. On the basis of its review, the staff found that, because these components will be inspected one time before the period of extended operation for whether aging has occurred, the aging effects of cracking and loss of material of SS components exposed to an internal environment of untreated air will be effectively managed by the One-Time Inspection Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Fire Protection System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-12

The staff reviewed LRA Table 3.3.2-14-12, which summarizes the results of AMR evaluations for the fire protection system nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-12, the applicant proposed to manage loss of material of SS, carbon steel, gray cast iron, copper alloy with greater than 15 percent zinc, and copper alloy with less than 15 percent zinc material for nozzle, orifice, piping, tubing, and valve body component types exposed to an internal environment of treated water using AMP B.1.13.2, "Fire Water System Program."

The staff's evaluation of the Fire Water System Program is documented in SER Section 3.0.3.2.11. This program is consistent with GALL AMP XI.M27, "Fire Water System," with enhancements and an exception. On the basis of its review, the staff found that, because these components will be inspected periodically and tested, the aging effect of loss of material of carbon steel, gray cast iron, SS, copper alloy with greater than 15 percent zinc, and copper alloy with less than 15 percent zinc components exposed to an internal environment of treated water will be effectively managed by the Fire Water System Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Fuel Oil Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-13

The staff reviewed LRA Table 3.3.2-14-13, which summarizes the results of AMR evaluations for the fuel oil storage and transfer system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.19 Fuel Pool Cooling and Demineralizer System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation – LRA Table 3.3.2-14-14

The staff reviewed LRA Table 3.3.2-14-14, which summarizes the results of AMR evaluations for the fuel pool cooling and demineralizer system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.20 Heating, Ventilation and Air Conditioning Systems, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation – LRA Table 3.3.2-14-15

The staff reviewed LRA Table 3.3.2-14-15, which summarizes the results of AMR evaluations for the HVAC system nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-11, the applicant proposed to manage cracking and change in material properties of elastomer material for expansion joint component types exposed to an internal environment of treated water using Periodic Surveillance and Preventive Maintenance Program.

The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The Periodic Surveillance and Preventive Maintenance Program description states that fan duct flexible connections in HVAC systems are visually inspected and manually flexed to manage cracking and change in material properties. On the basis of its review, the staff found that, because these components will be inspected periodically and manually flexed, the aging effects of cracking and change in material properties of elastomer components exposed to an internal environment of treated water will be effectively managed by the Periodic Surveillance and Preventive Maintenance Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results for material, environment, AERMs, 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 Offgas and Augmented Offgas System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-19

The staff reviewed LRA Table 3.3.2-14-19, which summarizes the results of AMR evaluations for the offgas and augmented offgas system nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-19, the applicant proposed to manage cracking due to fatigue of SS material for thermowell, tubing, and valve body component types exposed to an internal environment of steam greater than 270°F using the metal fatigue TLAA. The evaluation of metal fatigue is documented in SER Section 4.3.2.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-20

The staff reviewed LRA Table 3.3.2-14-20, which summarizes the results of AMR evaluations for the post-accident sampling system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.23 Potable and Sanitary Water System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation – LRA Table 3.3.2-14-21

The staff reviewed LRA Table 3.3.2-14-21, which summarizes the results of AMR evaluations for the potable and sanitary water system nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-21, the applicant proposed to manage loss of material of carbon steel, SS, copper alloy with greater than 15 percent zinc, and copper alloy with less than 15 percent zinc material for orifice, piping, pump casing, strainer housing, tubing, and valve body component types exposed to an internal environment of treated water using the Water Chemistry Control – Auxiliary Systems Program.

The staff's evaluation of the Water Chemistry Control – Auxiliary Systems Program is documented in SER Section 3.0.3.3.6. The program monitors conductivity, corrosion products, and dissolved oxygen in accordance with industry recommendations. On the basis of its review, the staff found that, because the water chemistry will be monitored periodically and controlled within established levels of contaminants, the aging effects of loss of material of carbon steel, SS, copper alloy greater than 15 percent zinc, and copper alloy less than 15 percent zinc material for orifice, piping, pump casing, strainer housing, tubing, and valve body component types exposed to an internal environment of treated water will be effectively managed by the Water Chemistry Control – Auxiliary Systems Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Containment Atmospheric Control System Summary of Aging Management Evaluation - LRA Table 3.3.2-14-22

The staff reviewed LRA Table 3.3.2-14-22, which summarizes the results of AMR evaluations for the primary containment atmospheric control system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.25 Radioactive Waste System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-23

The staff reviewed LRA Table 3.3.2-14-23, which summarizes the results of AMR evaluations for the radioactive waste system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.26 Reactor Building Closed Cooling Water System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation – LRA Table 3.3.2-14-24

The staff reviewed LRA Table 3.3.2-14-24, which summarizes the results of AMR evaluations for the RBCCW system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.27 Reactor Coolant System Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-26

The staff reviewed LRA Table 3.3.2-14-26, which summarizes the results of AMR evaluations for the RCPB nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.28 Reactor Water Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation – LRA Table 3.3.2-14-27

The staff reviewed LRA Table 3.3.2-14-27, which summarizes the results of AMR evaluations for the RWCU system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.29 Salt Service Water System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-29

The staff reviewed LRA Table 3.3.2-14-29, which summarizes the results of AMR evaluations for the SSW system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.30 Sampling Systems, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-30

The staff reviewed LRA Table 3.3.2-14-30, which summarizes the results of AMR evaluations for sampling system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.31 Sanitary Soiled Waste and Vent; Plumbing and Drains, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-31

The staff reviewed LRA Table 3.3.2-14-31, which summarizes the results of AMR evaluations for the sanitary soiled waste and vent; plumbing and drains nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.32 Screen Wash System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-32

The staff reviewed LRA Table 3.3.2-14-32, which summarizes the results of AMR evaluations for the screen wash system nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-32, the applicant proposed to manage loss nickel alloy material for piping component types exposed to an external environment of condensation using the System Walkdown Program.

The staff's evaluation of the System Walkdown Program is documented in SER Section 3.0.3.1.11. The System Walkdown Program description states that this program inspects external surfaces of components subject to AMR. This program is consistent with GALL AMP XI.M36, "External Surfaces Monitoring Program." On the basis of its review, the staff found that the aging effect of loss of material of nickel alloy piping exposed to an external environment of condensation will be effectively managed by the System Walkdown Program.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.33 Standby Liquid Control System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-33

The staff reviewed LRA Table 3.3.2-14-33, which summarizes the results of AMR evaluations for the SLC system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.2.3.34 Turbine Building Closed Cooling Water System, Nonsafety-Related Components Affecting Safety-Related Systems Summary of Aging Management Evaluation - LRA Table 3.3.2-14-34

The staff reviewed LRA Table 3.3.2-14-34, which summarizes the results of AMR evaluations for the TBCCW system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.3.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the auxiliary system components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4 Aging Management of Steam and Power Conversion System

This section of the SER documents the staff's review of the applicant's AMR results for the steam and power conversion system components and component groups of the following:

- condensate storage system
- MS, turbine generator auxiliaries, and main condenser
- miscellaneous systems within the Steam and power conversion system in-scope for 10 CFR 54.4(a)(2) (These Steam and power conversion subsystems are included in LRA Section 3.3, “Auxiliary Systems,” but evaluated in this section.)

3.4.1 Summary of Technical Information in the Application

LRA Section 3.4 provides AMR results for the Steam and power conversion system components and component groups. LRA Table 3.4.1, “Summary of Aging Management Evaluations for the Steam and Power Conversion System,” is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the steam and power conversion system components and component groups.

The applicant's AMRs 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 system components, that are 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 confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL 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 Audit and Review Report Section 3.4.2.1 and are summarized 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 Audit and Review Report Section 3.4.2.2 and summarized in SER Section 3.4.2.2.

In the onsite audit, the staff also conducted a technical review of the remaining AMRs not consistent with, or not addressed in, the GALL Report. The audit and technical review evaluated whether all plausible aging effects were identified and whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in Audit and Review Report Section 3.4.2.3 and summarized in SER Section 3.4.2.3. The staff's evaluation of the technical review is also documented in SER Section 3.4.2.3.

Finally, the staff reviewed the AMP summary descriptions in the UFSAR supplement for adequate descriptions of the programs credited with managing or monitoring aging for the steam and power conversion system components.

Table 3.4-1 summarizes the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.4, that are addressed in the GALL Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion System Components in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	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)	TLAA	Consistent with GALL Report, which recommends further evaluation (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	Water Chemistry (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.2)
Steel heat exchanger components exposed to treated water (3.4.1-3)	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	N/A	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	Water Chemistry (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.2)
Steel heat exchanger components exposed to treated water (3.4.1-5)	Loss of material due to general, pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Water Chemistry (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.9)
Steel and SS 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	Water Chemistry (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Sections 3.4.2.2.7 and 3.4.2.2.2 for steel tanks)
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	Oil Analysis (B.1.22)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.2)
Steel piping, piping components, and piping elements exposed to raw water (3.4.1-8)	Loss of material due to general, pitting, crevice, and microbiologically-infl uenced corrosion, and fouling	Plant-specific	Periodic Surveillance and Preventive Maintenance (B.1.24)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.3)
SS 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	None	Not applicable (See SER Section 3.4.2.2.4)
Steel, SS, 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	None	Not applicable (See SER Section 3.4.2.2.4)
Buried steel piping, piping components, piping elements, and tanks (with or without coating or wrapping) exposed to soil (3.4.1-11)	Loss of material due to general, pitting, crevice, and microbiologically-infl uenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	None	Not applicable (See SER Section 3.4.2.2.5)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	None	Not applicable (See SER Section 3.4.2.2.5)
SS piping, piping components, piping elements exposed to steam (3.4.1-13)	Cracking due to SCC	Water Chemistry and One-Time Inspection	Water Chemistry (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.6)
SS 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 SCC	Water Chemistry and One-Time Inspection	Water Chemistry – BWR (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.6)
Aluminum and copper alloy piping, piping components, and piping elements exposed to treated water (3.4.1-15)	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Water Chemistry – BWR (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.7)
SS 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	Water Chemistry – BWR (B.1.32.2) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.7)
SS piping, piping components, and piping elements exposed to soil (3.4.1-17)	Loss of material due to pitting and crevice corrosion	Plant-specific	Buried Piping and Tanks Inspection (B.1.2)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.7)
Copper alloy piping, piping components, and piping elements exposed to lubricating oil (3.4.1-18)	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Oil Analysis (B.1.22)	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.4.2.2.7)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS 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	Oil Analysis (B.1.22)	Consistent with GALL Report, which recommends further evaluation (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	System Walkdown Program (B.1.30) and One-Time Inspection (B.1.23)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.4.2.1)
High-strength steel closure bolting exposed to air with steam or water leakage (3.4.1-21)	Cracking due to cyclic loading, SCC	Bolting Integrity	None	Not applicable (See SER Section 3.4.2.3)
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	Bolting Integrity Program (B.1.33)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.4.2.1)
SS piping, piping components, and piping elements exposed to closed-cycle cooling water > 60°C (> 140°F) (3.4.1-23)	Cracking due to SCC	Closed-Cycle Cooling Water System	None	Not applicable (See SER Section 3.4.2.3)
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	None	Not applicable (See SER Section 3.4.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS 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	None	Not applicable (See SER Section 3.4.2.3)
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	None	Not applicable (See SER Section 3.4.2.3)
Steel, SS, 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	None	Not applicable (See SER Section 3.4.2.3)
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	System Walkdown Program (B.1.30)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.4.2.1)
Steel piping, piping components, and piping elements exposed to steam or treated water (3.4.1-29)	Wall thinning due to FAC	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion (B.1.11)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.4.2.1)
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	Periodic Surveillance and Preventive Maintenance Program (B.1.24)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.4.2.1.1)
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	Periodic Surveillance and Preventive Maintenance Program (B.1.24)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.4.2.1.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS 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	Periodic Surveillance and Preventive Maintenance Program (B.1.24)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.4.2.1.3)
SS 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	None	Not applicable (See SER Section 3.4.2.3)
Steel, SS, 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	None	Not applicable (See SER Section 3.4.2.3)
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	Selective Leaching of Materials (B.1.25)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.4.2.1)
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	Selective Leaching of Materials (B.1.25)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.4.2.1)
Steel, SS, 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	Water Chemistry – BWR (B.1.32.2)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.4.2.1)
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	N/A	Not applicable to BWRs

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS piping, piping components, and piping elements exposed to steam (3.4.1-39)	Cracking due to SCC	Water Chemistry	N/A	Not applicable to BWRs
Glass piping elements exposed to air, lubricating oil, raw water, and treated water (3.4.1-40)	None	None	None	Consistent with GALL Report (See SER Section 3.4.2.3)
SS, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air - indoor uncontrolled (external) (3.4.1-41)	None	None	None	Consistent with GALL Report (See SER Section 3.4.2.3)
Steel piping, piping components, and piping elements exposed to air - indoor controlled (external) (3.4.1-42)	None	None	None	Not applicable (See SER Section 3.4.2.3)
Steel and SS piping, piping components, and piping elements in concrete (3.4.1-43)	None	None	None	Not applicable (See SER Section 3.4.2.3)
Steel, SS, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas (3.4.1-44)	None	None	None	Not applicable (See SER Section 3.4.2.3)

The staff's review of the steam and power conversion system 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 steam and power conversion system components is documented in SER Section 3.0.3.

3.4.2.1 AMR Results That Are Consistent with the GALL Report

Summary of Technical Information in the Application. LRA Section 3.4.2.1, the applicant identifies the materials, environments, and AERMs and the following programs that manage the effects of aging for the steam and power conversion system components:

- Buried Piping and Tanks Inspection Program
- FAC Program
- Periodic Surveillance and Preventive Maintenance Program
- Selective Leaching Program
- System Walkdown Program
- Water Chemistry Control - BWR Program
- Water Chemistry Control - Auxiliary Systems Program
- One-Time Inspection Program
- Oil Analysis Program
- Bolting Integrity Program

Staff Evaluation. LRA Tables 3.4.2-1 and 3.4.2-2 summarize AMRs for the steam and power conversion system components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the GALL Report and for which the GALL Report does not recommend further evaluation, the staff 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 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 AMP. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL 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 AMP. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the in the GALL Report 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 from the GALL 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. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL 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 identified AMP would manage the aging effect consistently with the GALL AMP and whether the AMR was valid for the site-specific conditions.

The staff audited and reviewed the information provided in the LRA as documented in Audit and Review Report Section 3.4.2.1. 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 AMRs.

3.4.2.1.1 Loss of Material Due to General, Pitting, and Crevice Corrosion

In LRA Table 3.4.2-1, "Condensate Storage System," (page 3.4-29) which cites Table 3.4.1, items 3.4.1-20 and 3.4.1-30, the applicant proposed to manage loss of material of steel tanks (condensate storage tanks) exposed to an air-outdoor external environment and condensation internal environment using System Walkdown Program, and Periodic Surveillance and Preventive Maintenance Program, respectively. However, the AMP recommended by the GALL Report for this AERM is GALL AMP XI.M29, "Aboveground Steel Tanks Program." The applicant referred to Note E to the Table 2 line items indicating that a different AMP is credited.

The staff reviewed the AMR result lines referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report. The staff review of the applicant's System Walkdown Program and Periodic Surveillance and Preventive Maintenance Program and its evaluation is documented in SER Sections 3.0.3.1.11 and 3.0.3.3.5, respectively. The staff found the use of the System Walkdown Program and Periodic Surveillance and Preventive Maintenance Program to manage loss of material due to general, pitting, and crevice corrosion for condensate storage tanks acceptable because both programs manage material degradation through visual inspections. However, GALL AMP XI.M29, "Aboveground Steel Tanks Program," has some detection of aging effects attributes not addressed in the System Walkdown Program or Periodic Surveillance and Preventive Maintenance Program. For example, the GALL AMP specifies that thickness measurement of the tank bottom be taken so significant degradation does not occur and the component intended function will be maintained during the period of extended operation. The staff asked the applicant to clarify how it will detect aging effects at the tank bottom surface.

In its response dated September 13, 2006, the applicant stated that, so significant degradation on the bottom of the condensate storage tanks does not occur, there would be a one-time UT examination in accessible areas on the tank bottom utilizing standard examination and sampling techniques. This statement is Commitment No. 36. In addition, the applicant revised LRA Table 3.4.1, item 3.4.1-20, to specify the One-Time Inspection Program, so significant degradation on the bottom of the condensate storage tanks does not occur. The applicant also revised the One-Time Inspection Program description and LRA Section A.2.1.25 to include a one-time inspection UT examination on the bottom of the condensate storage tanks before the period of extended operation.

On the basis of its review, the staff found that by committing to a UT inspection on the condensate storage tank bottom, the applicant adequately addressed the AEM as recommended by the GALL Report.

3.4.2.1.2 Loss of Material Due to General, Pitting, and Crevice Corrosion; Loss of Preload Due to Thermal Effects, Gasket Creep, and Self-Loosening

Originally, the applicant did not include a Bolting Integrity Program in the LRA. Instead, the applicant credited the System Walkdown Program to manage loss of material for steel bolting. GALL AMP XI.M18, "Bolting Integrity," makes several recommendations in the 10-element evaluation (*e.g.*, selection of bolting materials, use of lubricants and sealants, and additional NUREG-1339 recommendations). The System Walkdown Program may be acceptable for inspection; however, it does not address preventive actions. For LRA Section 3.4, this fact applies to Table 3.4.1, item 3.4.1-22. During the audit and review, the staff asked the applicant to clarify how it meets these recommendations or to provide justification why there should be no bolting program.

In its response, the applicant stated that a Bolting Integrity Program will be developed to address the aging management of bolting within the scope of license renewal and a copy of the AMP basis will be provided for review. The LRA will be supplemented in Appendices A and B to describe the Bolting Integrity Program and to indicate where the program applies. Subsequently, in a letter dated July 19, 2006, the applicant provided a 10-element description of its Bolting Integrity Program and stated that the program applies to all bolting exposed to air with AERMs except RV closure studs. The staff's review of the Bolting Integrity Program is documented in SER Section 3.0.3.2.9. The staff concluded that the applicant's Bolting Integrity Program will adequately manage the aging effects in the LRA for which this AMP is credited. Because the applicant's Bolting Integrity Program applies to steel bolting and closure bolting exposed to air where the applicant had referred to Note E, the staff found Bolting Integrity Program acceptable because it brings the component, material, environment, aging effect, and AMP for these components into compliance with what is described in the GALL Report.

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 found that the applicant adequately addressed the AEM as recommended by the GALL Report.

3.4.2.1.3 Loss of Material Due to General, Pitting, and Crevice Corrosion and Microbiologically-Influenced Corrosion

In LRA Table 3.3.2-14-1, "condensate storage system," which cites Table 3.4.1, items 3.4.1-31 and 3.4.1-32, the applicant proposed to manage loss of material of steel heat exchanger (shell) and SS and copper alloy piping, piping components, and piping elements exposed to raw water using Periodic Surveillance and Preventive Maintenance Program. However, the AMP recommended by the GALL Report for this AERM is GALL AMP XI.M20, "Open-Cycle Cooling Water System Program." The applicant referred to Note E to the Table 2 line items, indicating a different AMP credited.

The staff reviewed the AMR result lines referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report. The staff review of the applicant's Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The staff found the use of the Periodic Surveillance and Preventive Maintenance Program to manage loss of material of steel heat exchanger (shell) and SS and copper alloy piping, piping components, and piping elements exposed to raw water acceptable because the Periodic Surveillance and Preventive Maintenance Program detects leakage and manages material degradation through periodic visual inspections. The staff concluded that this AMP addressed the AEM as recommended by the GALL Report.

On the basis of its review, the staff found that the applicant adequately addressed the loss of material due to general, pitting and crevice corrosion and MIC for steel heat exchanger (shell) and SS and copper alloy piping, piping components, and piping elements exposed to raw water.

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 the associated aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with the AMRs in the GALL Report. 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 for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.4.2.2, the applicant further evaluated aging management, as recommended by the GALL Report, for steam and power conversion system components and provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and 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

Staff Evaluation. For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the GALL Report and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against SRP-LR Section 3.4.2.2 criteria. Details of the staff's audit are documented in Audit and Review Report Section 3.4.2.2. The staff's review of the applicant's further evaluation follows.

3.4.2.2.1 Cumulative Fatigue Damage

The staff reviewed the AMR line items in Table 2s for the steam and power conversion system in which fatigue-induced damage (to which the AMR line items refer as "fatigue - cracking") was shown as an AERM and in which the "TLAA - Metal Fatigue" was credited as the basis for management of the aging effect. This SER will refer to these AMR line items in Table 2s for the steam and power conversion systems as "AMRs on Non-Class 1 Fatigue" and to the relevant TLAA as the "TLAA on Metal Fatigue of Non-Class 1 Components."

The staff confirmed that LRA Table 3.4.1,item 3.4.1-1 includes no AMRs on Non-Class 1 Fatigue for the condensate storage system commodity groups. The staff also confirmed that LRA Table 3.4.1, item 3.4.1-2 includes AMRs on Non-Class 1 Fatigue for the piping, tubing, valve casings, and orifices in the main condenser and MS isolation valve (MSIV) leakage pathway.

The staff also reviewed the applicant's TLAA on Metal Fatigue of Non-Class 1 Components in LRA Section 4.3.2. The staff determined that the applicant had indicated that all of the AMRs on Non-Class 1 Fatigue of the main condenser and MSIV leakage pathway components were within the scope of the B31.1 fatigue analysis in LRA Section 4.3.2. However, the staff determined that the AMRs on Non-Class 1 Fatigue did not clearly indicate which steam and power conversion system commodity groups were designed to B31.1 requirements and which were not. Thus, the staff could not conclude that the TLAA on Metal Fatigue of Non-Class 1 Components was adequate aging management for those Non-Class 1 commodity groups designed to a code other than B31.1. During the audit and review, the staff asked the applicant to respond to the following requests:

(1) which design codes were applied to the non-piping commodity groups in the Non-Class 1 Fatigue AMRs for the steam and power conversion systems

(2) clarify whether the design codes required a metal fatigue analysis and summarize the type of metal fatigue analysis calculation required, if applicable

(3) discuss how the metal fatigue analysis was acceptable in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii), if applicable

(4) propose an acceptable AMP to manage fatigue-induced damage for the period of extended operation if the design code for the particular Non-Class 1 commodity group required no metal fatigue analysis

In its letter dated September 13, 2006, the applicant did not indicate any main condenser and MSIV leakage pathway components for which the TLAA on Metal Fatigue was credited with aging management of fatigue-induced damage and for which the components were designed in accordance with a code other than B31.1.

An additional staff review of the AMRs on Non-Class 1 Fatigue for the main condenser and MSIV leakage pathway components confirmed that all of the commodity groups in these AMR line items were designed in accordance with B31.1. Therefore, the staff concludes that use of the TLAA on Metal Fatigue of Non-Class 1 Components is valid and acceptable as the basis for managing fatigue-induced damage in the main condenser and MSIV leakage pathway components because (1) these components are designed to B31.1, (2) B31.1 includes a metal fatigue analysis methodology for B31.1-designed components, and (3) LRA Section 4.3.2 includes a B31.1-based fatigue assessment for these components. The staff reviewed the ability of the TLAA on Metal Fatigue to manage fatigue-induced damage in these Non-Class 1 Components, and its evaluation is in SER Section 4.3.2.2.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.4.2.2.1. For those line items that apply to LRA Section 3.4.2.2.1, 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).

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.2 against the following SRP-LR Section 3.4.2.2.2 criteria:

(1) In LRA Section 3.4.2.2.2, the applicant states that there are no heat exchanger components in the steam and power conversion systems except components in-scope based solely on 10 CFR 54.4(a)(2). The condensers are included as parts of the main condenser and MSIV leakage pathway but have no AERMs because their intended function is for holdup and plateout of radioactive materials.

SRP-LR Section 3.4.2.2.2 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and for steel piping, piping components, and piping elements exposed to steam. The existing AMP monitors and controls 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 with stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion does not occur. 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 does not occur and that component intended functions will be maintained during the period of extended operation.

The applicant also stated that the loss of material due to general, pitting, and crevice corrosion for carbon steel piping, piping components, and tanks exposed to treated water and for carbon steel piping and components exposed to steam is an AERM in the steam and power conversion systems managed by the Water Chemistry Control – BWR and Periodic Surveillance and Preventive Maintenance programs. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components crediting this program, including those in susceptible locations like areas of stagnant flow. The Periodic Surveillance and Preventive Maintenance Program uses visual inspections and other NDE techniques to manage loss of material for carbon steel tanks in the condensate storage system.

The discussion column of LRA Table 3.4.1, items 3.4.1-2, 3.4.1-4, and 3.4.1-6 states that the One-Time Inspection Program will verify the effectiveness of the water chemistry control program. However, for those line items in Tables 3.4.2-2, and 3.3.2-14-x referring to these Table 3.4.1 line items, only the Water Chemistry Control – BWR Program is credited. The staff asked the applicant why the One-Time Inspection Program was not credited in the Table 2 line items that refer to these Table 1 line items.

In its response dated July 19, 2006, the applicant stated that the effectiveness of the Water Chemistry Control – Auxiliary Systems, BWR, and Closed Cooling Water programs is confirmed by the One-Time Inspection Program and revised LRA Appendix A (UFSAR Supplement) for these three water chemistry control programs to include the sentence, "The One-Time Inspection Program will confirm the effectiveness of the program."

The staff's evaluation of the Water Chemistry Control – BWR Program and One-Time Inspection Program is documented in SER Sections 3.0.3.1.13 and 3.0.3.1.8, respectively. The staff reviewed the applicant's Water Chemistry Control – BWR Program and verified that this AMP monitors and controls water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. In addition, the staff verified that the One-Time Inspection Program inspects to verify the effectiveness of the water chemistry control program to manage loss of material due to general, pitting, and crevice corrosion at locations with stagnant flow conditions. The staff concluded that these AMPs will adequately manage loss of material due to general, pitting, and crevice corrosion for steel piping, piping components, and piping elements exposed to steam and for steel piping, piping components, and piping elements exposed to treated water.

In the discussion column entry of Table 3.4.1-6, the applicant states that the Periodic Surveillance and Preventive Maintenance Program applies to the condensate storage tanks. During the audit and review, the staff asked the applicant to clarify whether it uses the Periodic Surveillance and Preventive Maintenance Program alone to manage the loss of material for the condensate storage tanks.

In response the applicant stated that it intended to use the Water Chemistry Control – BWR Program in conjunction with the Periodic Surveillance and Preventive Maintenance Program to manage the effects of aging for the condensate storage tanks surfaces exposed to a treated water environment. The staff's review of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The applicant also stated that the corresponding LRA Table 2 items will be supplemented to clarify this point.

In its response dated July 19, 2006, the applicant revised LRA Table 3.4.2-1 to include the Water Chemistry Control – BWR Program in addition to the Periodic Surveillance and Preventive Maintenance Program to manage aging effects for condensate storage tanks.

The staff found this response acceptable because the applicant's Water Chemistry Control – BWR Program and Periodic Surveillance and Preventive Maintenance Program are more conservative than the GALL Report recommendations. The GALL Report recommends the use of a water chemistry program and one-time inspection program. The staff finds this acceptable because the Periodic Surveillance and Preventive Maintenance Program inspects more frequently than the one-time inspection.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.4.2.2.2.1 for further evaluation.

(2) LRA Section 3.4.2.2.2 states that a loss of material due to general, pitting, and crevice corrosion for steel piping and components in steam and power conversion systems exposed to lubricating oil is managed by the Oil Analysis Program. This aging effect applies only to components in the turbine generator and auxiliary system and is included in the evaluation of systems within the scope of license renewal based on 10 CFR 54.4(a)(2) (see LRA Table 3.3.2-14-35). The Oil Analysis Program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. Plant-specific operating experience confirms the effectiveness of this program in maintaining contaminants within limits so corrosion does not affect component intended functions.

SRP-LR Section 3.4.2.2.2 states that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements exposed to lubricating oil. The existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion does not occur. 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 does not occur and that component intended functions will be maintained during the period of extended operation.

In the discussion column of Table 3.4.1, item 3.4.1-7, the applicant stated that it depends on operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the staff asked the applicant how it can make this statement if there has been no inspection.

In response the applicant added that during routine maintenance on components that contain lubricating oil visual inspections of these components would detect degraded conditions that could be attributed to an ineffective Oil Analysis Program. The corrective action program has a low threshold for the detection of degraded conditions and would detect component corrosion or cracking. In plant-specific operating experience for the last five years there were no condition that indicated an ineffective Oil Analysis Program or degraded component conditions like corrosion or cracking in a lubricating oil environment.

The applicant also stated that during corrective and preventive maintenance activities in the past five years, there have been many visual inspections of components containing lubricating oil. The visual inspection of these components would detect degraded conditions like corrosion or cracking that could be attributed to an ineffective Oil Analysis Program. No condition reports of degraded component conditions like corrosion or cracking in a lubricating oil environment followed these inspections. These past inspections serve in lieu of a one-time inspection to confirm the effectiveness of the Oil Analysis Program.

The staff reviewed the license renewal project operating experience review report and confirmed that there were no condition reports of degraded conditions of components in a lubricating oil environment. On the basis of periodic inspections of components in a lubricating oil environment during maintenance activities and operating experience reporting no degraded conditions, the staff determined that the Oil Analysis Program is appropriate assurance that the effects of aging will be effectively managed through the period of extended operation. The Oil Analysis Program was evaluated by the staff and found acceptable for managing aging degradation. The staff's evaluation of the Oil Analysis Program is documented in SER Section 3.0.3.2.13. The staff found the program acceptable for managing aging degradation.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.4.2.2.2.2 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.4.2.2.2. For those line items that apply to LRA Section 3.4.2.2.2, the staff determines that the LRA is consistent with the GALL Report and 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).

3.4.2.2.3 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion, and Fouling

The staff reviewed LRA Section 3.4.2.2.3 against the criteria in SRP-LR Section 3.4.2.2.3.

LRA Section 3.4.2.2.3 states that a loss of material due to general, pitting, crevice, and MIC and fouling in steel piping, piping components, and piping elements exposed to raw water is managed by the Periodic Surveillance and Preventive Maintenance Program, which uses visual inspections and other NDE techniques to manage loss of material for carbon steel components.

SRP-LR Section 3.4.2.2.3 states that loss of material due to general, pitting, crevice, and MIC, and fouling may occur in steel piping, piping components, and piping elements exposed to raw water. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

During the audit and review, the staff asked the applicant for the specific components in the circulating water system represented by five line items in Table 3.3.2-14-1 referring to Table 3.4.1, item 3.4.1-8 and crediting the Periodic Surveillance and Preventive Maintenance Program. The staff found that the applicant's Periodic Surveillance and Preventive Maintenance Program uses visual or other NDE techniques to inspect representative circulating water system samples to manage internal loss of material. The staff's evaluation of the Periodic Surveillance and Preventive Maintenance Program is documented in SER Section 3.0.3.3.5. The staff concluded that this AMP will assure detection of leakage before the loss of its intended function and will adequately manage loss of material due to general, pitting, crevice, and MIC and fouling in steel piping, piping components, and piping elements exposed to raw water.

The staff found that, based on the programs reviewed, the applicant adequately addressed loss of material due to general, pitting, crevice, and MIC and fouling for steel piping, piping components, and piping elements exposed to raw water.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.4.2.2.3. For those line items that apply to LRA Section 3.4.2.2.3, the staff determines that the LRA is consistent with the GALL Report and 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).

3.4.2.2.4 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.4.2.2.4 against the following SRP-LR Section 3.4.2.2.4 criteria:

(1) LRA Section 3.4.2.2.4 states that the steam and power conversion system has no heat exchanger tubes with an intended function of heat transfer and aging effect of fouling and that in Table 3.4.1, item 3.4.1-9, the only components to which this GALL Report line item applies are in the HPCI and RCIC systems.

The staff noted that there are no Table 2 line items in the steam and power conversion system that refer to Table 3.4.1, item 3.4.1-9. Because no components from this group are in the steam and power conversion system, the staff agrees with the applicant that this aging effect is not applicable.

(2) LRA Section 3.4.2.2.4 states that the steam and power conversion system has no heat exchanger tubes with an intended function of heat transfer and aging effect of fouling and stated that in Table 3.4.1, item 3.4.1-10, the only components to which this GALL Report line item applies are in the SBO diesel generator and security diesel generator systems.

The staff noted that there are no Table 2 line items in the steam and power conversion system that refer to Table 3.4.1, item 3.4.1-10. Because no components from this group are in the steam and power conversion system, the staff agrees with the applicant that this aging effect is not applicable to this component type.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.4.2.2.4. As indicated above, no line items apply to LRA Section 3.4.2.2.4.

3.4.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.4.2.2.5 against the following SRP-LR Section 3.4.2.2.5 criteria:

(1) LRA Section 3.4.2.2.5 states that the steam and power conversion system has no carbon steel components exposed to soil. This item is not applicable.

The staff noted that there are no Table 2 line items in the steam and power conversion system that refer to Table 3.4.1, item 3.4.1-11. Because there are no components from this group, the staff found this aging effect not applicable.

(2) LRA Section 3.4.2.2.5 states that the steam and power conversion system has no heat exchanger components exposed to lubricating oil. This item is not applicable.

The staff noted that there are no Table 2 line items in the steam and power conversion system that refer to Table 3.4.1, item 3.4.1-12. Because there are no components from this group, the staff found this aging effect not applicable.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.4.2.2.5. As indicated above, no line items apply to LRA Section 3.4.2.2.5.

3.4.2.2.6 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.4.2.2.6 against the criteria in SRP-LR Section 3.4.2.2.6.

LRA Section 3.4.2.2.6 states that cracking due to SCC in SS components exposed to steam is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components crediting this program, including those in susceptible locations like areas of stagnant flow.

SRP-LR Section 3.4.2.2.6 states that cracking due to SCC may occur in the SS piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60 °C (>140 °F), and for SS piping, piping components, and piping elements exposed to steam. The existing AMP monitors and controls water chemistry to manage the effects of cracking due to SCC. However, high concentrations of impurities at crevices and locations with 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 does not occur. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that SCC does not occur and that component intended functions will be maintained during the period of extended operation.

The discussion column of LRA Table 3.4.1, items 3.4.1-13 and 3.4.1-14 states that the One-Time Inspection Program will verify the effectiveness of the water chemistry control program. However, line items in Tables 3.4.2-2, 3.3.2-14-9, 3.3.2-14-16, 3.3.2-14-18, and 3.3.2-14-19 referring to Table 3.4.1 line items credit only the Water Chemistry Control – BWR Program. The staff asked why the One-Time Inspection Program was not credited in the Table 2 line items that refer to these Table 1 line items. The applicant's response and the staff's evaluation are documented in SER Section 3.4.2.2.2 (1).

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.4.2.2.6 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.4.2.2.6. 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 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).

3.4.2.2.7 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.7 against the following SRP-LR Section 3.4.2.2.7 criteria:

(1) LRA Section 3.4.2.2.7 states that the loss of material due to pitting and crevice corrosion for SS and copper alloy components exposed to treated water is managed by the Water Chemistry Control – BWR Program. There are no aluminum components in the steam and power conversion systems. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components crediting this program, including those in susceptible locations like areas of stagnant flow.

    SRP-LR Section 3.4.2.2.7 states that loss of material due to pitting and crevice corrosion may occur in SS, aluminum, and copper alloy piping, piping components and piping elements and for SS tanks and heat exchanger components exposed to treated water. The existing AMP monitors and controls 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 with stagnant flow conditions. Therefore, the GALL Report recommends that the effectiveness of the water chemistry program should be verified to ensure that corrosion does not occur. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The discussion column of LRA Table 3.4.1, items 3.4.1-15 and 3.4.1-16 states that the One-Time Inspection Program will verify the effectiveness of the water chemistry control program. However, line items in Tables 3.4.2-1 and various 3.3.2-14-x referring to these Table 3.4.1 line items in the steam and power conversion system credit only the Water Chemistry Control – BWR Program. The staff asked why the One-Time Inspection Program was not credited in the Table 2 line items that refer to these Table 1 line items. The applicant's response and the staff's evaluation are documented in SER Section 3.4.2.2.2 (1).

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.4.2.2.7.1 for further evaluation.

(2) LRA Section 3.4.2.2.7 states that the loss of material due to pitting and crevice corrosion for SS piping and tubing exposed to soil is managed by the Buried Piping and Tanks Inspection Program. This program will include (a) preventive measures to mitigate corrosion, and (b) inspections to manage the effects of corrosion on the pressure-retaining capability of buried components. Buried components will be inspected when excavated during maintenance. There will be an inspection within the first 10 years of the period of extended operation unless an opportunistic inspection occurs within this 10-year period. This program will manage the aging effect of loss of material so component intended functions will not be affected.

SRP-LR Section 3.4.2.2.7 states that loss of material due to pitting and crevice corrosion may occur in SS piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

The staff reviewed the Buried Piping and Tanks Inspection Program, which is consistent with GALL AMP XI.M34. The staff's evaluation of the Buried Piping and Tanks Inspection Program is documented in SER Section 3.0.3.2.1. On the basis of periodic inspections, including opportunistic inspections, on buried piping, the staff determined that the Buried Piping and Tanks inspection Program is adequate assurance that the effects of aging will be effectively managed through the period of extended operation.

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.4.2.2.7.2 for further evaluation.

(3) LRA Section 3.4.2.2.7 states that loss of material due to pitting and crevice corrosion for copper alloy steam and power conversion system components exposed to lubricating oil is managed by the Oil Analysis Program. This aging effect applies only to components in the turbine generator and auxiliary system and is included in the evaluation of systems within the scope of license renewal based on 10 CFR 54.4(a)(2) (see LRA Table 3.3.2-14-35).

The Oil Analysis Program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. Plant-specific operating experience confirms the effectiveness of this program in maintaining contaminants within limits so corrosion does not affect component intended functions.

SRP-LR Section 3.4.2.2.7 states that loss of material due to pitting and crevice corrosion may occur in copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion does not occur. 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 does not occur and that component intended functions will be maintained during the period of extended operation.

In the discussion column of Table 3.4.1, item 3.4.1-18, which linked to LRA Section 3.4.2.2.7.3, the applicant stated that it depends on operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the staff asked the applicant how it can make this statement if there has been no inspection. The applicant's response and the staff's evaluation are documented in SER Section 3.4.2.2.2 (2).

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.4.2.2.7.3 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.4.2.2.7. For those line items that apply to LRA Section 3.4.2.2.7, the staff determines that the LRA is consistent with the GALL Report and 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).

3.4.2.2.8 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.4.2.2.8 against the criteria in SRP-LR Section 3.4.2.2.8.

LRA Section 3.4.2.2.8 states that a loss of material due to pitting, crevice, and microbiologically-influenced corrosion (MIC) for SS steam and power conversion system components exposed to lubricating oil is managed by the Oil Analysis Program. This aging effect applies only to components in the turbine generator and auxiliary system and is included in the evaluation of systems within the scope of license renewal based on 10 CFR 54.4(a)(2) (see LRA Table 3.3.2-14-35). The Oil Analysis Program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. Plant-specific operating experience, as discussed in SER Section 3.0.3.2.13, confirms the effectiveness of this program in maintaining contaminants within limits so corrosion does not affect component intended functions.

SRP-LR Section 3.4.2.2.8 states that loss of material due to pitting, crevice, and MIC may occur in SS piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil. The existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits to preserve an environment not conducive to corrosion. However, control of lube oil contaminants may not always be fully effective in precluding corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion does not occur. 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 does not occur and that component intended functions will be maintained during the period of extended operation.

In the discussion column of Table 3.4.1,item 3.4.1-19, which linked to LRA Section 3.4.2.2.8, the applicant stated that it depends on operating experience to verify the effectiveness of the Oil Analysis Program. During the audit and review, the staff asked the applicant how it can make this statement if there has been no inspection. The applicant's response and the staff's evaluation are documented in SER Section 3.4.2.2.2 (2).

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.4.2.2.8 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.4.2.2.8. For those line items that apply to LRA Section 3.4.2.2.8, the staff determines that the LRA is consistent with the GALL Report and 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).

3.4.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

The staff reviewed LRA Section 3.4.2.2.9 against the criteria in SRP-LR Section 3.4.2.2.9.

LRA Section 3.4.2.2.9 states that a loss of material due to general, pitting, crevice, and galvanic corrosion for steel heat exchanger components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program through inspections of representative samples of components crediting this program, including those in susceptible locations like areas of stagnant flow.

SRP-LR Section 3.4.2.2.9 states that loss of material due to general, pitting, crevice, and galvanic corrosion can occur for steel heat exchanger components exposed to treated water. The existing AMP monitors and controls 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 with stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion does not occur. 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 does not occur and that component intended functions will be maintained during the period of extended operation.

The discussion column of LRA Table 3.4.1, item 3.4.1-5 states that the One-Time Inspection Program will verify the effectiveness of the water chemistry control program. However, Table 3.3.2-14-x line items referring to these Table 3.4.1 line items credit only the Water Chemistry Control – BWR Program. The staff asked the applicant why the One-Time Inspection Program was not credited in the Table 2 line items that reference these Table 1 line items. The applicant's response and the staff's evaluation are documented in SER Section 3.4.2.2.2 (1).

The staff found that, based on the programs reviewed, the applicant has met the criteria of SRP-LR Section 3.4.2.2.9 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.4.2.2.9. For those line items that apply to LRA Section 3.4.2.2.9, 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).

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 for safety-related and nonsafety-related components.

3.4.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.4.2-1, 3.4.2-2, 3.3.2-14-1, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18, and 3.3.2-14-35, 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, 3.4.2-2, 3.3.2-14-1, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18, and 3.3.2-14-35, the applicant indicated, via notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information 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.

Staff Evaluation. 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.

Aging Effects/Mechanisms in Table 3.4.1 Not Applicable to PNPS. The LRA Table 3.4.1, item 3.4.1-21 discussion column states that cracking due to cyclic loading SCC of the high-strength steel closure bolting exposed to air with steam or water leakage is not applicable because high-strength steel closure bolting is not used in the steam and power conversion system.

Because there is no high-strength steel closure bolting in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

The LRA Table 3.4.1, item 3.4.1-23 discussion column states that cracking due to SCC of SS piping, piping components, and piping elements exposed to CCW greater than 140°F is not applicable because there are no SS components exposed to CCW in the steam and power conversion system.

Because there are no SS components exposed to CCW in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

The LRA Table 3.4.1, item 3.4.1-24 discussion column states that the loss of material due to general, pitting, crevice, and galvanic corrosion of steel heat exchanger components exposed to CCW is not applicable because there are no steel heat exchanger components exposed to CCW in the steam and power conversion system.

Because there are no steel heat exchanger components exposed to CCW in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

The LRA Table 3.4.1, item 3.4.1-25 discussion column states that the loss of material due to pitting and crevice corrosion of SS piping, piping components, piping elements, and heat exchanger components exposed to CCW is not applicable because there are no SS components exposed to CCW in the steam and power conversion system.

Because there are no SS components exposed to CCW in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

The LRA Table 3.4.1, item 3.4.1-26 discussion column states that the loss of material due to pitting, crevice, and galvanic corrosion of copper alloy piping, piping components, and piping elements exposed to CCW is not applicable because there are no copper alloy components exposed to CCW in the steam and power conversion system.

Because there are no copper alloy components exposed to CCW in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

The LRA Table 3.4.1, item 3.4.1-27 discussion column states that reduction of heat transfer due to fouling of steel, SS, and copper alloy heat exchanger tubes exposed to CCW is not applicable because there are no heat exchanger tubes exposed to CCW in the steam and power conversion system.

Because there are no heat exchanger tubes exposed to CCW in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

The LRA Table 3.4.1, item 3.4.1-33 discussion column states that loss of material due to pitting, crevice, and MIC and fouling of SS heat exchanger components exposed to raw water is not applicable because there are no SS heat exchanger components exposed to raw water in the steam and power conversion system.

Because there are no SS heat exchanger components exposed to raw water in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

The LRA Table 3.4.1, item 3.4.1-34 discussion column states that the reduction of heat transfer due to fouling of steel, SS, and copper alloy heat exchanger tubes exposed to raw water is not applicable because there are no heat exchanger tubes with a heat transfer intended function exposed to raw water in the steam and power conversion system.

Because there are no heat exchanger tubes with a heat transfer intended function exposed to raw water in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

The LRA Table 3.4.1, item 3.4.1-42 discussion column states that the aging of steel piping, piping components, and piping elements exposed to controlled indoor air is not applicable because there are no steel components exposed to controlled indoor air in the steam and power system.

Because there are no steel components exposed to controlled indoor air in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

The LRA Table 3.4.1, item 3.4.1-43 discussion column states that the aging of steel and SS piping, piping components, and piping elements in concrete is not applicable because there are no steel or SS components exposed to concrete in the steam and power conversion system.

Because there are no steel or SS components exposed to concrete in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

The LRA Table 3.4.1, item 3.4.1-44 discussion column states that the aging of steel, SS, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas is not applicable because there are no steel, SS, aluminum, or copper alloy components exposed to gas in the steam and power conversion system.

Because there are no steel, SS, aluminum, or copper alloy components exposed to gas in the steam and power conversion system the staff finds this aging effect not applicable to this component type.

Steam and Power Conversion System AMR Line Items With No Aging Effect (LRA Tables 3.4.2-1, 3.4.2-2, 3.3.2-14-1, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18, and 3.3.2-14-35). LRA Tables 3.4.2-1, 3.4.2-2, 3.3.2-14-1, 3.3.2-14-3 through 3.3.2-14-5, 3.3.2-14-9 through 3.3.2-14-11, 3.3.2-14-17, 3.3.2-14-18, and 3.3.2-14-35, indicate AMR line items with no aging effects found in the applicant's aging review process. Specifically, instances in which the applicant states that no aging effects were found occurred in the following areas:

Condenser Components Fabricated from Carbon Steel, Copper Alloy, Titanium, and Elastomer Exposed to Indoor Air, Treated Water, or Steam Greater than 270°F. LRA Table 3.4.2-2 (pages 3.4-31 and 32), via plant-specific Note 401, states that:

> Aging management of the main condenser is not based on analysis of materials, environments and aging effects. Condenser integrity required to perform the post-accident intended function (holdup and plateout of MSIV leakage) is continuously confirmed by normal plant operation. This intended function does not require the condenser to be leak-tight, and the post-accident conditions in the condenser will be essentially atmospheric. Since normal plant operation assures adequate condenser pressure boundary integrity, the post-accident intended function to provide holdup volume and plateout surface is assured. Based on past precedence (NUREG-1796, Dresden and Quad Cities SER, Section 3.4.2.4.4, and NUREG-1769, Peach Bottom SER, Section 3.4.2.3), the staff concluded that main condenser integrity is continually verified during normal plant operation and no AMP is required to assure the post-accident intended function.

The staff reviewed precedents and noted a similar intended function for the main condenser. The staff found that, to maintain the intended function of plateout and holdup during post-accident conditions, the main condenser and main condenser complex components must remain intact. Normal plant operations monitor condenser vacuum continuously to verify its integrity. The acceptable performance of the main condenser during normal plant operation is adequate assurance that it will perform the plateout and holdup post-accident function. Therefore, the staff agreed with the applicant's conclusion that no AMP is required to assure the post-accident intended function and that this aging effect is not applicable.

Glass in Condensation External Environment (Table 3.3.2-14-1). Glass as a material is impervious to normal plant environments. 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 has been recorded in industry at the temperatures or during the time periods of concern for extended operation.

Plastic in Condensation External and Raw Water Internal Environments (Table 3.3.2-14-1). As stated in Section 2.1.8 of Appendix A of EPRI Technical Report 1003056, "Non-Class 1 Mechanical Implementation Guidelines and Mechanical Tools," Revision 3, PVC and thermoplastics are relatively unaffected by water or humidity.

Unlike metals, plastics display no corrosion rates. Rather than depend on an oxide layer for protection, they depend on chemical resistance to the environment to which they are exposed.

Therefore, based on industry experience and the assumption of proper design and application of the material, the staff concludes that aging of plastics in condensation external and raw water internal environments is not an applicable aging effect.

On the basis of its review of industry research and operating experience, the staff found that for plastic and glass condensation external and raw water internal environments will not cause aging of concern during the period of extended operation. Therefore, the staff concluded that there are no applicable AERMs for plastic and glass components exposed to condensation external and raw water internal environments. Furthermore, the staff concluded that for condenser components fabricated from carbon steel, copper alloy, titanium, and elastomer exposed to indoor air, treated water, or steam greater than 270°F environments, there are no aging effects, and no AMP is required to assure post-accident function.

3.4.2.3.1 Condensate Storage 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 condensate storage system component groups.

In LRA Table 3.4.2-1, the applicant proposed to manage loss of material for SS for bolting, piping, tubing, and valve body component types exposed to an external environment of condensation using System Walkdown Program.

The staff review of the System Walkdown Program is documented in SER Section 3.0.3.1.11. The System Walkdown Program description states that this program inspects external surfaces of components subject to an AMR. This program is consistent with GALL AMP XI.M36, "External Surfaces Monitoring Program."

The staff found that, based on its review, the aging effect of loss of material for bolting, piping, tubing, and valve body component types exposed to an external environment of condensation will be effectively managed by the System Walkdown Program.

On the basis of its review, the staff finds that the applicant adequately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Main Condenser and Main Steam Isolation Valve Leakage Pathway 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 main condenser and MS isolation valve leakage pathway component groups.

In LRA Table 3.4.2-2, the applicant proposed to manage cracking due to fatigue of SS material for orifice, thermowell, tubing, and valve body component types exposed to an internal environment of steam greater than 270°F using the metal fatigue TLAA. The evaluation of metal fatigue TLAA is documented in SER Section 4.3.2.

On the basis of its review, the staff finds that the applicant adequately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-3

The staff reviewed LRA Table 3.3.2-14-3, which summarizes the results of AMR evaluations for the condensate system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.5 Condensate Demineralizer System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-4

The staff reviewed LRA Table 3.3.2-14-4, which summarizes the results of AMR evaluations for the condensate demineralizer system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.6 Condensate Storage and Transfer System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-5

The staff reviewed LRA Table 3.3.2-14-5, which summarizes the results of AMR evaluations for the condensate storage and transfer system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.7 Extraction Steam System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-9

The staff reviewed LRA Table 3.3.2-14-9, which summarizes the results of AMR evaluations for the extraction steam nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-9, the applicant proposed to manage cracking due to fatigue of nickel alloy and SS materials for expansion joint, tubing, and valve body component types exposed to an internal environment of steam or treated water greater than 270°F using the metal fatigue TLAA. The evaluation of the metal fatigue TLAA is documented in SER Section 4.3.2.

In Table 3.3.2-14-9, the applicant proposed to manage cracking and loss of material of nickel alloy material for expansion joint component types exposed to an environment of steam or treated water greater than 270°F using Water Chemistry Control – BWR Program.

The staff's evaluation of the Water Chemistry Control – BWR Program is documented in SER Section 3.0.3.1.13. This program is consistent with GALL AMP XI.M2, "Water Chemistry." The staff found that, because the water chemistry will be periodically monitored and controlled within established levels of contaminants, the aging effect of cracking and loss of material of nickel alloy material for component type of expansion joint exposed to an environment of steam or treated water greater than 270°F will be effectively managed by the Water Chemistry Control – BWR Program. However, there was no verification of the effectiveness of the program. The staff asked the applicant why the One-Time Inspection Program was not credited in the Table 2 line items. The applicant's response and the staff's evaluation are documented in SER Section 3.4.2.2.2 (1).

The staff concluded that these AMPs will adequately manage cracking and loss of material of nickel alloy material for component type of expansion joint exposed to an environment of steam or treated water greater than 270°F.

On the basis of its review, the staff finds that the applicant adequately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Feedwater System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-10

The staff reviewed LRA Table 3.3.2-14-10, which summarizes the results of AMR evaluations for the feedwater system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.9 Feedwater Heater Drains and Vents System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-11

The staff reviewed LRA Table 3.3.2-14-11, which summarizes the results of AMR evaluations for the feedwater heater drains and vents system nonsafety-related component groups affecting safety-related systems. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.10 Main Condenser – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-17

The staff reviewed LRA Table 3.3.2-14-17, which summarizes the results of AMR evaluations for the main condenser nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-17, the applicant proposed to manage cracking due to fatigue of SS material for orifice component types exposed to an internal environment of steam greater than 270°F using the metal fatigue TLAA. The staff's evaluation of the metal fatigue TLAA is documented in SER Section 4.3.2.

3.4.2.3.11 Main Steam System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-18

The staff reviewed LRA Table 3.3.2-14-18, which summarizes the results of AMR evaluations for the MS system nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-18, the applicant proposed to manage cracking due to fatigue of SS material for orifice and tubing component types exposed to an internal environment of steam greater than 270°F using the metal fatigue TLAA. The staff's evaluation of the metal fatigue TLAA is documented in SER Section 4.3.2.

3.4.2.3.12 Turbine Generator and Auxiliaries System – Summary of Aging Management Evaluation – LRA Table 3.3.2-14-35

The staff reviewed LRA Table 3.3.2-14-35, which summarizes the results of AMR evaluations for the turbine generator and auxiliary system nonsafety-related component groups affecting safety-related systems.

In LRA Table 3.3.2-14-35, the applicant proposed to manage loss of material of carbon steel, SS, and copper alloy less than 15 percent zinc materials for filter housing, heater exchanger (shell), heater housing, orifice, piping, pump casing, strainer housing, tank, thermowell, tubing, and valve body component types exposed to a treated water environment using Water Chemistry Control – Auxiliary Systems Program.

The staff's evaluation of the Water Chemistry Control – Auxiliary Systems Program is documented in SER Section 3.0.3.3.6. The program monitors conductivity, corrosion products, and dissolved oxygen in accordance with industry recommendations. On the basis of its review, the staff found the aging effect of loss of material of carbon steel, SS, and copper alloy less than 15 percent zinc materials for filter housing, heater exchanger (shell), heater housing, orifice, piping, pump casing, strainer housing, tank, thermowell, tubing, and valve body component types exposed to a treated water environment is effectively managed by Water Chemistry Control – Auxiliary Systems Program. However, verification of the effectiveness of the Water Chemistry Control – Auxiliary Systems Program is not described in the corresponding LRA Table 2 line items. The staff asked the applicant why the One-Time Inspection Program was not credited in these Table 2 line items. The applicant's response and the staff's evaluation are documented in SER Section 3.4.2.2.2 (1).

The staff concluded that these AMPs will adequately manage loss of material of carbon steel, SS, and copper alloy less than 15 percent zinc materials for filter housing, heater exchanger (shell), heater housing, orifice, piping, pump casing, strainer housing, tank, thermowell, tubing, and valve body component types exposed to a treated water environment.

On the basis of its review, the staff finds that the applicant adequately evaluated the AMR results involving material, environment, AERMs, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the Steam and power conversion system components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5 Aging Management of Structures and Component Supports

This section of the SER documents the staff's review of the applicant's AMR results for the structures, and component support components and component groups of the following:

- primary containment
- reactor building
- intake structure
- process facilities
- yard structures
- bulk commodities

3.5.1 Summary of Technical Information in the Application

In LRA Section 3.5, the applicant provided AMR results for structural components and component groups. In LRA Table 3.5.1, "Summary of Aging Management Evaluations for the Structures and Component Supports," the applicant provided a summary comparison of its AMRs with those evaluated in the GALL Report for structural 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 reviews of CRs and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the structures and component supports components, that are 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 confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and whether the applicant identified the appropriate GALL 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 Audit and Review Report Section 3.5.2.1and are summarized in SER Section 3.5.2.1.

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 SRP-LR Section 3.5.2.2 acceptance criteria. The staff's audit evaluations are documented in Audit and Review Report Section 3.5.2.2 and summarized in SER Section 3.5.2.2.

In the onsite audit, the staff also conducted a technical review of the remaining AMRs not consistent with, or not addressed in, the GALL Report. The audit and 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 audit evaluations are documented in Audit and Review Report Section 3.5.2.3 and are summarized in SER Section 3.5.2.3. The staff's evaluation of the technical review is also documented in SER Section 3.5.2.3.

Finally, the staff reviewed the AMP UFSAR supplement summary descriptions for adequate descriptions of the programs credited with managing or monitoring aging for the structures and component supports components.

Table 3.5-1 includes a summary of the staff's evaluation of components, AEMs, and AMPs, listed in LRA Section 3.5 and addressed in the GALL Report.

Table 3.5-1 Staff Evaluation for Structures and Component Supports in the GALL Report

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
BWR Concrete and Steel (Mark I, II, and III) 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.	None	Not applicable (See SER Section 3.5.2.2.1)
Concrete elements; All (3.5.1-2)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	None	Not applicable (See SER Section 3.5.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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.	None	Not applicable (See SER Section 3.5.2.2.1)
Concrete elements: dome, wall, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable) (3.5.1-4)	Reduction of strength and modulus of concrete due to elevated temperature	A plant-specific AMP is to be evaluated	None	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
Steel elements: Drywell; torus; drywell head; embedded shell and sand pocket regions; drywell support skirt; torus ring girder; downcomers; liner plate, ECCS suction header, support skirt, region shielded by diaphragm floor, suppression chamber (as applicable) (3.5.1-5)	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Containment Inservice Inspection Program Containment Leak Rate Program Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
Steel elements: steel liner, liner anchors, integral attachments (3.5.1-6)	Loss of material due to general, pitting and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Containment Inservice Inspection Program Containment Leak Rate Program Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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)	N/A	Not applicable (See SER Section 3.5.2.2.1)
Steel and SS elements: vent line, vent header, vent line bellows; downcomers; (3.5.1-8)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
Steel, SS elements, dissimilar metal (DSM) 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)	TLAA	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
SS penetration sleeves, penetration bellows, DSM welds (3.5.1-10)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examinations/ evaluations for bellows assemblies and DSM welds.	Containment Inservice Inspection Containment Leak Rate Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
SS vent line bellows, (3.5.1-11)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examination/ evaluation for bellows assemblies and DSM welds.	Containment Inservice Inspection Containment Leak Rate Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
Steel, SS elements, DSM 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	Containment Inservice Inspection Containment Leak Rate Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel, SS elements, DSM welds: torus; vent line; vent header; vent line bellows; downcomers (3.5.1-13)	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks	Containment Inservice Inspection Containment Leak Rate Program	Consistent with GALL Report (See SER Section 3.5.2.2.1)
Concrete elements: dome, wall, basemat ring girder, buttresses, containment (as applicable) (3.5.1-14)	Loss of material (Scaling, cracking, and spalling) due to freeze-thaw	ISI (IWL). Evaluation is needed for plants that are located in moderate to severe weather conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	None	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
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-77.	None	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.1)
Seals, gaskets, and moisture barriers (3.5.1-16)	Loss of sealing and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	ISI (IWE) and 10 CFR Part 50, Appendix J	Containment Inservice Inspection Containment Leak Rate Program Structures Monitoring Program	Consistent with GALL Report (See SER Section 3.5.2.1)
Personnel airlock, equipment hatch and CRD hatch locks, hinges, and closure mechanisms (3.5.1-17)	Loss of leak tightness in closed position due to mechanical wear of locks, hinges and closure mechanisms	10 CFR Part 50, Appendix J and Plant Technical Specifications	Containment Inservice Inspection Containment Leak Rate Program	Consistent with GALL Report (See SER Section 3.5.2.1)
Steel penetration sleeves and DSM 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	Containment Inservice Inspection Containment Leak Rate Program	Consistent with GALL Report (See SER Section 3.5.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Steel elements: SS suppression chamber shell (inner surface) (3.5.1-19)	Cracking due to SCC	ISI (IWE) and 10 CFR Part 50, Appendix J	None	Not applicable (See SER Section 3.5.2.3)
Steel elements: suppression chamber liner (interior surface) (3.5.1-20)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	None	Not applicable (See SER Section 3.5.2.3)
Steel elements: drywell head and downcomer pipes (3.5.1-21)	Fretting or lock up due to mechanical wear	ISI (IWE)	Containment Inservice Inspection	Consistent with GALL Report (See SER Section 3.5.2.1)
Prestressed containment: tendons and anchorage components (3.5.1-22)	Loss of material due to corrosion	ISI (IWL)	None	Not applicable (See SER Section 3.5.2.3)
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	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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.	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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 weather conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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.	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
Groups 1-3, 5-9: All (3.5.1-28)	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
Groups 1-3, 5-9: foundation (3.5.1-29)	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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.	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
Groups 1-3, 5, 7-9: exterior above and below grade reinforced concrete foundations (3.5.1-32)	Increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide	Structures Monitoring Program for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
Groups 1-5: concrete (3.5.1-33)	Reduction of strength and modulus due to elevated temperature	A plant-specific AMP is to be evaluated	None	Not applicable (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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.	Inspection of Water-Control Structures	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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 weather conditions (weathering index > 100 day-inch/yr) (NUREG-1557).	Inspection of Water-Control Structures	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Group 6: all accessible/ 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.	Inspection of Water-Control Structures	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
Group 6: exterior above and below grade reinforced concrete foundation interior slab (3.5.1-37)	Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide	For accessible areas, Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Inspection of Water-Control Structures	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
Groups 7, 8: Tank liners (3.5.1-38)	Cracking due to SCC; loss of material due to pitting and crevice corrosion	A plant-specific AMP is to be evaluated	None	Not applicable (See SER Section 3.5.2.2.2)
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	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Vibration isolation elements (3.5.1-41)	Reduction or loss of isolation function/radiation hardening, temperature, humidity, sustained vibratory loading	Structures Monitoring Program	Structures Monitoring Program	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.5.2.2.2)
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)	None	Not applicable (See SER Section 3.5.2.2.2)
Groups 1-3, 5, 6: all masonry block walls (3.5.1-43)	Cracking due to restraint shrinkage, creep, and aggressive environment	Masonry Wall Program	Masonry Wall Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.5.2.1)
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	Structures Monitoring Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.5.2.1)
Group 6: exterior above and below grade concrete foundation; interior slab (3.5.1-45)	Loss of material due to abrasion, cavitation	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance	Inspection of Water-Control Structures	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.5.2.1)
Group 5: Fuel pool liners (3.5.1-46)	Cracking due to SCC; 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.	Water Chemistry Control	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.5.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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.	Inspection of Water-Control Structures	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.5.2.1)
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	Inspection of Water-Control Structures	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.5.2.2.2)
Support members; welds; bolted connections; support anchorage to building structure (3.5.1-49)	Loss of material/general, pitting, and crevice corrosion	Water Chemistry and ISI (IWF)	Water Chemistry ISI (IWF)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.5.2.1)
Groups B2, and B4: galvanized steel, aluminum, SS 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	Structures Monitoring Program	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.5.2.1)
Group B1.1: high strength low-alloy bolts (3.5.1-51)	Cracking due to SCC; loss of material due to general corrosion	Bolting Integrity	None	Not applicable (See SER Section 3.5.2.3)
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	None	Not applicable (See SER Section 3.5.2.3)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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)	ISI (IWF)	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.5.2.1)
Groups B1.1, B1.2, and B1.3: Constant and variable load spring hangers; guides; stops; (3.5.1-54)	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	None	Not applicable (See SER Section 3.5.2.3)
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	N/A	Not applicable to BWRs
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)	ISI (IWF)	Consistent with GALL Report (See SER Section 3.5.2.2.2)
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)	None	Not applicable (See SER Section 3.5.2.3)
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	None	Consistent with GALL Report (See SER Section 3.5.2.2.2)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
SS support members; welds; bolted connections; support anchorage to building structure (3.5.1-59)	None	None	None	Consistent with GALL Report (See SER Section 3.5.2.2.2)

The staff's review of the structural components and component groups followed any one of several approaches. One approach, documented in SER Section 3.5.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.5.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.5.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the structures and component supports components is documented in SER Section 3.0.3.

3.5.2.1 AMR Results Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.5.2.1, the applicant identified the materials, environments, AERMs, and the following programs that manage aging effects for the structures and component supports components:

- Containment Leak Rate Program
- Fire Protection Program
- Containment Inservice Inspection Program
- Inservice Inspection Program
- Periodic Surveillance and Preventive Maintenance Program
- Masonry Wall Program
- Structures Monitoring Program
- Water Control Structures Monitoring Program
- Water Chemistry Control - BWR Program

In LRA Tables 3.5.2-1 through 3.5.2-6, the applicant provided a summary of AMRs for the structures and component support components and identified which AMRs it considered to be consistent with the GALL Report.

Staff Evaluation. For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the GALL Report and for which the GALL Report does not recommend further evaluation, the staff 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, which indicate 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 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 AMP. The staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the applicant's AMP is consistent with the GALL 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 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 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. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the applicant's AMP was consistent with the GALL 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 a different AMP is credited. 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 consistent with the GALL AMP and whether the AMR was valid for the site-specific conditions.

The staff audited and reviewed the information in the LRA, as documented in Audit and Review Report 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 AMRs. The staff's evaluation is discussed below.

3.5.2.1.1 Loss of Sealing and Leakage through Containment Due to Deterioration of Joint Seals, Gaskets, and Moisture Barriers (Caulking, Flashing, and Other Sealants)

During the audit and review, the staff noted that the discussion column of LRA Table 3.5-1, item 3.5.1-16, states that seals and gaskets are not included in the Containment Inservice Inspection Program. One of the components for this item number is moisture barriers. The staff asked the applicant to explain how it seals the joint between the containment drywell shell and drywell concrete floor if there is no moisture barrier and why the inspection of this joint is not part of the Containment Inservice Inspection Program.

In a letter dated July 19, 2006, the applicant stated that the primary containment has no moisture barrier. Therefore, an AMP is not required. The referenced line item on page 3.5-55 applies only to primary containment electrical penetration seals and sealant. Table 3.5.1, item 3.5.1-16 is revised to read:

> The aging effects cited in the NUREG-1801 Item are loss of sealing and leakage. Loss of sealing is a consequence of the aging effect, cracking, and change in material properties. For PNPS, the Containment Leak Rate Program manages cracking and change in material properties for the primary containment seals and gaskets. The Structures Monitoring Program manages cracking and change in material properties for the reactor building equipment lock doors. There is no moisture barrier where the drywell steel shell becomes embedded in the drywell concrete floor.

On the basis of its review, the staff found the response acceptable because the applicant adequately addressed the AEM as recommended by the GALL Report.

For loss of sealing and leakage through containment due to deterioration of elastomer, rubber, and other similar material joint seals, gaskets, and moisture barriers (caulking, flashing, and other sealants) exposed to indoor uncontrolled air or outdoor air, the GALL Report recommends programs consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE," and GALL AMP XI.S4, "10 CFR Part 50, Appendix J."

However, the applicant manages cracking and change in material properties due to deterioration of the elastomer drywell floor liner seal (moisture barrier) exposed to environments protected from weather with the Containment Inservice Inspection Program. The moisture barrier is a containment internal seal and, therefore, 10 CFR Part 50, Appendix J does not apply.

The staff's evaluation of the Containment Inservice Inspection Program is documented in SER Section 3.0.3.3.2. The Containment Inservice Inspection Program encompasses the ASME Code Section XI, Subsection IWE requirements for managing the deterioration (cracking and change in material properties) of the primary containment moisture barrier through visual inspections.

Because the applicant's Containment Inservice Inspection Program requirements for inspection and detection of deterioration of the primary containment moisture barrier through visual inspections are the same as those of ASME Code Section XI, Subsection IWE, the staff found it an acceptable management program for detecting cracking and change in material properties.

For loss of sealing and leakage through containment due to deterioration of elastomer, rubber, and other similar material joint seals, gaskets, and moisture barriers (caulking, flashing, and other sealants) exposed to indoor uncontrolled air or outdoor air, the GALL Report recommends programs consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE," and GALL AMP XI.S4, "10 CFR Part 50, Appendix J."

However, the applicant manages cracking and change in material properties due to deterioration of the elastomer primary containment electrical penetration seals and sealant exposed to an environment protected from weather are managed using the Containment Leak Rate Program (with exceptions to the GALL Report).

The staff's evaluation of the Containment Leak Rate Program is documented in SER Section 3.0.3.2.8. The staff determined that the Containment Leak Rate Program is the only AMP needed to detect deterioration of the containment electrical penetration seals and sealant. Although the GALL Report specifies GALL AMP XI.S1, "ASME Section XI, Subsection IWE," also for this material, environment, and aging effect, the 1998 Edition and later editions of the ASME Code Section XI, Subsection IWE, do not require the inspection of seals and gaskets.

Because the applicant's Containment Leak Rate Program is consistent with the GALL Report (with exceptions) and the 1998 Edition and later editions of the ASME Code Section XI, Subsection IWE, do not require the inspection of seals and gaskets, the staff found the Containment Leak Rate Program alone is an acceptable aging management program for detecting cracking and change in material properties of containment electrical penetration seals and sealants.

On the basis of its review, the staff found that the applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.2 Loss of Leak Tightness in Closed Position Due to Mechanical Wear of Locks, Hinges, and Closure Mechanisms

The discussion column of LRA Table 3.5.1, item 3.5.1-17 states that locks, hinges, and closure mechanisms are active components and therefore not subject to an AMR. During the audit and review, the applicant was asked for any license renewal regulatory guidance document or previous LRA SER stating that locks, hinges, and closure mechanisms are active components. If locks, hinges, and closure mechanisms are active components, the applicant was asked for an itemized list of them with their qualified life or specified time period of replacement. The applicant was also asked to explain how it tracks the active life of these components before replacement.

During interviews with the staff, the applicant's personnel stated that to refer to these components as active components may be a misnomer because 10 CFR 54.21(a)(1)(I) does not refer to active or passive components, but excludes from AMR components that perform intended functions as described in 10 CFR 54.4, with moving parts or with a change in configuration or properties. Locks, hinges, and closure mechanisms perform their functions with moving parts. This exception is not based on a qualified life or specified time period for component replacement. Section 54.21(a)(1)(ii) of 10 CFR separately excludes components replaced based on a qualified life. Other precedents for locks, hinges, and closure mechanisms as active components approved by the NRC are in Peach Bottom (NUREG-1769, Section 3.03.14.2, page 3-58) and Millstone (NUREG-1838, Section 3.3A.2.1.4, page 3-245).

The staff determined that these components are not within the scope of license renewal.

On the basis of its review, the staff found the applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.3 Loss of Material Due to General, Pitting, and Crevice Corrosion

In the discussion column of LRA Table 3.5.1, item 3.5.118, the applicant stated:

> For loss of material due to general, pitting and crevice corrosion of steel (and dissimilar metal welds) penetration sleeves, personnel airlock, equipment hatch and CRD hatch exposed to indoor uncontrolled air or outdoor air, the GALL Report recommends programs consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE" and GALL AMP XI.S4, "10 CFR Part 50, Appendix J."

However, the applicant manages loss of material of the carbon steel CRD removal hatch, equipment hatch, personnel airlock, primary containment electrical penetrations, torus electrical penetrations, and torus mechanical penetrations exposed to environments protected from weather using the Containment Inservice Inspection Program (plant-specific) and the Containment Leak Rate Program (with exceptions to the GALL Report).

The staff's evaluation of the applicant's Containment Inservice Inspection Program is documented in SER Section 3.0.3.3.2. The Containment Inservice Inspection Program encompasses the ASME Code Section XI, Subsection IWE requirements for managing the loss of material for the primary containment and its integral attachments.

Because the applicant's Containment Inservice Inspection Program requirements for inspection and detection of loss of material for the primary containment and its integral attachments are the same as those of ASME Code Section XI, Subsection IWE, the staff found it an acceptable management program for loss of material of the above components.

On the basis of its review, the staff found that the applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.4 Fretting or Lockup Due to Mechanical Wear

In the discussion column of LRA Table 3.5.1, item 3.5.1-21, the applicant stated that plant-specific operating experience has not detected fretting or lockup due to mechanical wear for the drywell head and downcomers. During the audit and review, the staff noted that plant operating experience does not detect fretting or lockup due to mechanical wear – inspections do. The staff asked the applicant to explain whether it inspects for wear of the drywell head and downcomer pipes under the CLB using the Containment Inservice Inspection Program. If it inspects these components for wear, the applicant was asked to justify not inspecting during an extended license period. The applicant was asked for drawings, if required, showing the spatial distance between components so fretting cannot occur.

During interviews with the staff, the applicant's technical personnel stated that condition reports are primary sources of operating experience documentation for license renewal. Condition reports document negative inspection results. The GALL Report defines neither"fretting" nor "lockup" and further confuses the subject by stating that fretting and lockup are caused by mechanical wear, an aging mechanism causing the aging effect loss of material. The definition in the GALL Report, Section IX.E, merely states that fretting and lockup are aging effects with causes not what it is or what it looks like. As indicated in the line item for drywell head in LRA Table 3.5.2-1, the Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program manage loss of material, the aging effect caused by mechanical wear. The applicant inspects the drywell head and downcomers (torus vent system) per the requirements of ASME Code Section XI. In addition, the drywell head and downcomers are stationary, well-braced components, and the spatial distance between connecting components makes fretting and lockup unlikely to occur.

Based on the above discussion, the staff determined that fretting and lockup are unlikely to occur.

On the basis of its review, the staff found that the applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.5 Loss of Material Due to General and Pitting Corrosion

In the discussion column of LRA Table 3.5-1, item 3.5.1 -39, the applicant stated:

> For loss of material due to general, pitting, and crevice corrosion of steel support members, welds, bolted connections; and support anchorage to building structures exposed to indoor uncontrolled air or outdoor air, the GALL Report recommends programs consistent with GALL AMP XI.S6, "Structures Monitoring Program."

However, for AMR results line items that refer to Table 3.5.1, item 3.5.1-39, the applicant states that loss of material of carbon steel fire hose reels and damper framing exposed to environments protected from weather is managed by the Fire Protection Program. However, the discussion column of Table 3.5.1, item 3.5.1-39, does not credit the Fire Protection Program. Moreover, based on the program description and the enhancements, the Fire Water System Program seems to be the appropriate program that should have been credited. In RAI 3.5.1-1 dated August 14, 2006, the staff asked the applicant to justify why the Fire Protection Program was not credited and identify the correct program that should have been credited in the discussion column of Table 3.5.1, item 3.5.1-39.

In its response dated September 13, 2006, the applicant stated that the AMP listed in LRA Table 3.5.2-6 line item for damper framing is correct. The Fire Protection Program manages loss of material for steel fire damper frames. The valves in Section B.1.13.2, Fire Water System Program description have no dampers; they are valves in piping containing water. Damper frames are not included in this program. The AMP listed in LRA Table 3.5.2-6 line item for fire hose reels should cite the Fire Water System Program, which manages loss of material for fire hose reels.

The discussion column of LRA Table 3.5.1, item 3.5.1-39 is revised to state:

> Consistent with NUREG-1801 for most components. Structures Monitoring program will manage aging effects identified by this line item. The Fire Protection Program manages aging effects for steel fire damper frames and the Fire Water System Program manages aging effects for fire hose reels.

The staff's evaluation of the Fire Water System Program is documented in SER Section 3.0.3.2.11. The Fire Water System Program applies to water-based fire protection systems which consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations (including fire hose reels), standpipe, and above-ground and underground piping and components.

Components are tested by National Fire Protection Association (NFPA) codes and standards to assure that carbon steel fire hose reels and damper housing are inspected for corrosion (loss of material).

Because the applicant's Fire Water System Program includes hose stations (including fire hose reels) tested by NFPA codes and standards to detect corrosion, the staff found it an acceptable management program in lieu of the Structures Monitoring Program for loss of material of fire hose reels.

The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3.2.10. The program is enhanced to require visual inspection of components when the diesel-driven fire pump is running to verify that no degradation is occurring.

Based on the discussion above and the change to the LRA, the staff finds the applicant's response acceptable.

On the basis of its review, the staff found the applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.6 Loss of Sealing Due to Deterioration of Seals, Gaskets, and Moisture Barriers (Caulking, Flashing, and Other Sealants)

During the audit and review, the staff noted that in LRA Table 3.5.2-6 on page 3.5-83 for component seals and gaskets (doors, hatches, and manways), material rubber is environment protected from weather and the aging effects are cracking and change in material properties. The AMP shown is the Structures Monitoring Program. The GALL Report line item is III.A6-12, and the Table 1 reference is 3.5.1-44. The note shown is E, an AMP different from that shown in the GALL Report. However, the GALL Report Item III.A6-12 and Table 1 Item 3.5.1-44 both specify the Structures Monitoring Program. The staff asked the applicant to explain why the note shown is not A instead of E for the lower half of this AMR line item.

In a letter dated July 19, 2006, the applicant stated that in LRA Table 3.5.2-6 on page 3.5-83 for structure and/or component/commodity of seals and gaskets, material rubber in environments protected from weather, Note E was used because it applies to the top half of the line item. The LRA is clarified to indicate that Note A applies to the lower half of the line item.

In the upper half of this line item, the applicant refers to Table 1 line item 3.5.1-16 and for this line item the GALL Report recommends Containment Leak Rate and Containment Inservice Inspection Programs, and the applicant correctly specified Note E because in Table 2 the applicant credits the Structures Monitoring Program.

The staff's evaluation of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.2.17. The program will be enhanced with guidance for structural examinations of elastomers (seal, gasket, seismic joint filler, and roof elastomers) to detect cracking and change in material properties.

On the basis of its review, the staff found the response acceptable because the applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.7 Loss of Material Due to Abrasion, Cavitation

In the discussion column of LRA Table 3.5.1, item 3.5.1-45 states:

> For loss of material due to abrasion and cavitation of reinforced concrete exterior above and below grade foundation and interior slab exposed to flowing water, the GALL Report recommends programs consistent with GALL AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants."

However, the applicant manages loss of material of reinforced concrete exterior walls below grade (SSW area), exterior walls below grade (CWS area), foundation, interior walls below grade, exterior walls above grade, exterior walls below grade, and foundation (cooling tower) exposed to a fluid environment using the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. The staff determined that the attributes of GALL AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," applicable to the water control structures have been incorporated into the Structures Monitoring Program. On this basis, the staff found the Structures Monitoring Program an acceptable AMP for loss of listed component material.

However, there is no line item in the AMR results Table 2 referring to Table 3.5.1, item 3.5.1-45. In a letter dated August 14, 2006, RAI 3.5.1-2 was issued to ask the applicant to justify why this line item was not referenced.

In a letter dated September 13, 2006, the applicant responded that because the aging effects cited in the GALL Report for these components are not applicable for PNPS concrete, the line items for these group 6 components in Table 3.5.2-3 do not refer to GALL Report item 3.5.1-45. This treatment is the same as that of other concrete components in Table 3.5.2.x to which no aging effects apply. Accordingly, there is no reference to Table 3.5-1, item 3.5.1-45 but site-specific Note 501 indicates the AMP will confirm the absence of significant aging effects for the period of extended operation. The staff found the response acceptable.

On the basis of its review, the staff found the applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.8 Loss of Material Due to General (Steel Only), Pitting, and Crevice Corrosion

In the discussion column of LRA Table 3.5.1, item 3.5.1-47, the applicant stated:

> For loss of material due to general, pitting, and crevice corrosion of group six metal structural members exposed to indoor uncontrolled air, outdoor air, flowing water, or standing water, the GALL Report recommends programs consistent with GALL AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants."

However, the applicant manages loss of material of metal structural steel beams, columns, plates exposed to a protected-from-weather-or-fluid environment; metal anchorage/embedment exposed to a fluid environment; metal manway hatches and hatch covers exposed to a protected-from-weather or weather environment and structural bolting exposed to a fluid environment using the Structures Monitoring Program (with enhancements).

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. The applicant is not committed to RG 1.127. GALL AMP XI.S7 states that for plants not committed to RG 1.127, Revision 1, aging management of water control structures may be included in the Structures Monitoring Program. The attributes of GALL AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," applicable to the water control structures have been incorporated into the Structures Monitoring Program.

Because the applicant's Structures Monitoring Program includes the attributes of GALL AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," which is applicable to the water control structures, as permitted by the GALL Report, the staff found it an acceptable management program for loss of listed component material.

On the basis of its review, the staff found the applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.9 Loss of Material Due to General, Pitting, and Crevice Corrosion

In the discussion column of LRA Table 3.5.1, item 3.5.1-49, the applicant stated:

> For loss of material due to general, pitting, and crevice corrosion of stainless steel and steel support members; bolted connections; support anchorage to building structure exposed to treated water (< 140°F) the GALL Report recommends programs consistent with GALL AMP XI.M2, "Water Chemistry," for BWR water, and GALL AMP XI.S3, "ASME Section XI, Subsection IWF."

However, the applicant manages loss of material of carbon steel and SS anchorage/ embedments exposed to a fluid environment using the Water Chemistry Control – BWR Program and the Inservice Inspection Program.

The staff's evaluation of the Inservice Inspection Program is documented in SER Section 3.0.3.3.3. The Inservice Inspection Program encompasses the ASME Code Section XI, Subsection IWF requirements for managing the loss of material for ASME Classes 1, 2, and 3 steel piping supports and steel component supports within containment.

Because the applicant's plant-specific Inservice Inspection Program requirements for inspection and detection of loss of material for ASME Classes 1, 2, and 3 steel piping supports and steel component supports within containment are the same as those of ASME Code Section XI, Subsection IWF, the staff found it an acceptable management program for loss of carbon steel and SS anchorage/embedment material.

On the basis of its review, the staff found the applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.10 Loss of Material Due to Pitting and Crevice Corrosion

In the discussion column of LRA Table 3.5.1, item 3.5.1-50, the applicant stated that loss of material due to pitting and crevice corrosion of Groups B2 and B4 galvanized steel, aluminum, and SS components in an outdoor air environment is not applicable. During the audit and review, the staff noted that NUREG-1833 on page 93 for Item TP-6 states an approved precedent for adding this material, environment, aging effect, and program combination to the GALL Report. As shown in the H.B. Robinson SER Section 3.5.2.4.3.2, galvanized steel and SS in an outdoor air environment could cause loss of material due to constant wetting and drying conditions. Aluminum also would be susceptible to a similar aging effect in the outdoor environment. The applicant was asked to discuss the actual Group B2 and B4 galvanized steel, aluminum, and SS components within the scope of license renewal and exposed to an outdoor air environment. In addition, the applicant was asked to discuss the locations of these components and how they are protected from constant wetting and drying conditions.

During the audit and review, the applicant stated that loss of material due to pitting and crevice corrosion of aluminum and SS components in an outdoor environment is not applicable if the atmospheric environment is nonaggressive. The ambient environment is not chemically polluted by vapors of sulfur dioxide or similar substances and contains no saltwater or high-chloride content. In this nonaggressive environment, the occasional wetting and drying from normal outdoor weather causes no significant loss of material in aluminum or SS components. The conclusion that no aging effects require management for these materials in an outdoor air environment is supported by industry operating experience.

Components that may be considered in the B2 and B4 grouping are LRA Table 3.5.2-6 line items.

The AMR results for galvanized steel components in outdoor air should indicate loss of material as an aging effect with structures monitoring as the AMP. The discussion column entry for LRA Table 3.5.1, item 3.5.1-50, states that loss of material is not an applicable aging effect for SS or aluminum components in outdoor air.

The staff asked the applicant to justify why there is no aging effect for galvanized steel and stainless material in outdoor environments. Industry experience indicates an aging effect of loss of material. In a letter dated July 19, 2006, the applicant revised the LRA Table 3.5.1, item 3.5.1-50, discussion as follows:

> This aging effect is managed by the Structures Monitoring Program.

On the basis of its review, the staff found the response acceptable because the applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.11 Loss of Material Due to General and Pitting Corrosion

In the discussion column of LRA Table 3.5.1, item 3.5.1-53, the applicant stated that loss of material due to general and pitting corrosion is not an aging effect. For loss of material due to general and pitting corrosion of steel support members; welds, bolted connections; and support anchorage to building structure exposed to indoor uncontrolled air or outdoor air, the GALL Report recommends programs consistent with GALL AMP XI.S3, "ASME Section XI, Subsection IWF."

However, the applicant manages loss of material of steel RV support assembly, RV stabilizer supports, torus external supports (columns, saddles), anchorage/embedment, base plates, component and piping supports ASME Classes 1, 2, 3, and MC anchor bolts, and ASME Classes 1, 2, 3, and MC supports bolting exposed to environments protected from weather and anchorage/embedment, base plates, component and piping supports, ASME Classes 1, 2, 3, and MC anchor bolts, and ASME Class 1, 2, 3 and MC supports bolting exposed to a weather environment using the Inservice Inspection Program.

The staff's evaluation of the Inservice Inspection Program is documented in SER Section 3.0.3.3.3. The Inservice Inspection Program encompasses the ASME Code Section XI, Subsection IWF requirements for managing the loss of material for ASME Classes 1, 2, and 3 steel piping supports and steel component supports within containment.

Because the applicant's plant-specific Inservice Inspection Program requirements for inspection and detection of loss of material for ASME Classes 1, 2, and 3 steel piping supports and steel component supports within containment are the same as those of ASME Code Section XI, Subsection IWF, the staff found it an acceptable management program for loss of listed component material.

On the basis of its review, the staff found the response acceptable. The applicant adequately addressed the AEM, as recommended by the GALL Report.

3.5.2.1.12 Galvanized Steel and Aluminum Support Members: Weld; Bolted Connection; Support Anchorage to Building Structure

During the audit and review, the staff noted that in LRA Table 3.5.2-6 (page 3.5-73) for component electrical and instrument panels and enclosures, and for material galvanized steel in environments protected from weather, the aging effect is none. The GALL Report line item is III.B3-3, which is for the following components: support members, welds, bolted connections, and support anchorage to building structure. The staff asked the applicant to explain why the LRA AMR line item shows a Note A instead of a Note C, different component from the GALL Report line item, or, alternatively, a letter Note A with a number note explaining that the component is different.

In its response, the applicant stated that the GALL Report does not mention every type of component that may be subject to AMR (*e.g.*, panel is not in the GALL Report), nor does plant terminology always align with that in the GALL Report. Consequently, matching plant to GALL Report components is occasionally subjective. In this case, panels, which have no specific function other than to support and protect electrical equipment, were considered a support member, and Note A was applied. The use of either Note A or C has no real impact on the AMR results. Note A will be changed to Note C for component electrical and instrument panels and enclosures and galvanized steel in environments protected from weather in LRA Table 3.5.2-6 (page 3.5-73). No change is required to the other entries for this line item. In a letter dated September 13, 2006, the applicant revised LRA Table 3.5.2-6, page 3.5-73, for structure and/or component/commodity of electrical and instrument panels and enclosures, material galvanized steel, and environment protected from weather to specify Note C.

On the basis of its review, the staff found the response acceptable. The applicant adequately addressed the AEM, 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 the associated aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with the AMRs in the GALL Report. 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 for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2 AMR Results That Are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.5.2.2, the applicant further evaluated aging management, as recommended by the GALL Report, for the structures and component supports and provided information concerning how it will manage aging effects in the following three areas:

(1) PWR and BWR containments:

- aging of inaccessible concrete areas
- cracks and distortion due to increased stress levels from settlement; reduction of foundation strength, cracking and differential settlement due to erosion of porous concrete subfoundations, if not covered by the Structures Monitoring Program
- reduction of strength and modulus of concrete structures due to elevated temperature
- loss of material due to general, pitting and crevice corrosion
- loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- cumulative fatigue damage
- cracking due to SCC
- cracking due to cyclic loading
- loss of material (scaling, cracking, and spalling) due to freeze-thaw
- cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide

(2) safety-related and other structures and component supports:

- aging of structures not covered by 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 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 GALL 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 3.5.2.2. Details of the staff's audit are documented in Audit and Review Report Section 3.5.2.2. The staff's further evaluation of the aging effects follows.

3.5.2.2.1 PWR and BWR Containments

The staff reviewed LRA Section 3.5.2.2.1 against SRP-LR Section 3.5.2.2.1 criteria, 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.

LRA Section 3.5.2.2.1.1 addresses 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. The LRA states that a Mark I freestanding steel containment is within the reactor building. Inaccessible and accessible concrete areas are designed in accordance with American Concrete Institute (ACI) specification ACI 318-63, "Building Code Requirements for Reinforced Concrete," for low permeability and resistance to aggressive chemical solutions by requiring the following:

- high cement content
- low water-cement ratio
- proper curing
- adequate air entrainment

The applicant's concrete also meets requirements of the later ACI 201.2R-77, "Guide to Durable Concrete," as both documents use the same ASTM standards for selection, application, and testing of concrete.

The LRA states that the below-grade environment is nonaggressive (pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1500 ppm). The concrete has air content between 3 and 6 percent and a water-cement ratio between 0.44 and 0.60. Therefore, 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 are not applicable to concrete in inaccessible areas. The absence of concrete aging effects is confirmed by the Structures Monitoring Program.

The staff did not agree with the applicant that the absence of concrete aging effects provides evidence that the program effectively manages the effects of aging. The program is a monitoring program which uses qualified techniques and qualified operators capable of identifying the presence of concrete aging effects.

SRP-LR Section 3.5.2.2.1.1 states that increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel may occur in inaccessible areas of PWR and BWR concrete and steel containments. The existing program relies on ASME Code Section XI, Subsection IWL to manage these aging effects. However, the GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas in aggressive environments.

The staff found these aging effects not applicable to the PNPS Mark I freestanding steel containment. The listed possible aging effects apply to concrete elements of PWR containments and concrete BWR containments. The Mark I steel containment is located within the concrete reactor building, and the applicant statement is for that concrete structure.

On the basis that there are no components from this group, the staff concludes that this aging effect is not applicable to PNPS.

<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 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.

The LRA Section 3.5.2.2.1.2 states that for the crack 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), this aging effect is not applicable to PNPS. A Mark I freestanding steel containment is within the reactor building supported by the reactor building foundation. The applicant does not rely on a dewatering system for control of settlement. Structures are founded on dense to very dense silty sand and sand and gravel above the rock subgrade. PNPS containment was not in IN 97-11 as a plant susceptible to erosion of porous concrete subfoundations. Additionally, groundwater in-leakage is minimized by a waterproof membrane protecting the reactor building concrete against exposure to groundwater. Ground water was not aggressive during plant construction, and no changes in groundwater conditions have been observed.

The LRA states that as a result, cracking and distortion due to increased stress level from settlement and reduction of foundation strength cracking and differential settlement due to erosion of porous concrete subfoundation are not applicable to PNPS concrete structures.

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 program to manage these aging effects. Some plants may rely on a de-watering system to lower the site ground water 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 discussions with the applicant's technical personnel that, due to the absence of these aging mechanisms, 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. The applicant stated that the aging effects due to settlement are not anticipated for the PNPS Mark I steel containment since it is located within the reactor building and supported by the reactor building foundation. The reactor building is founded on dense to very dense silty sand, sand and gravel which prevents significant settlement. In addition, there is no porous concrete subfoundation of concern below the reactor building.

The staff determined that these aging effects are not applicable to the PNPS containment.

On the basis that PNPS has no components from this group, the staff concludes that this aging effect is not applicable.

Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature. The staff reviewed LRA Section 3.5.2.2.1.3 against the criteria in SRP-LR Section 3.5.2.2.1.3.

LRA Section 3.5.2.2.1.3 states that the aging effect of reduction of strength and modulus of concrete structures due to elevated temperature is not applicable to PNPS. ASME Code Section III, Division 2, Subsection CC indicates that aging due to elevated temperature exposure is not significant as long as concrete general area temperatures do not exceed 150°F and local area temperatures do not exceed 200°F. During normal operation, areas within primary containment are within these temperature limits; therefore, reduction of strength and modulus of concrete structures due to elevated temperature is not an AERM for PNPS containment concrete.

SRP-LR Section 3.5.2.2.1.3 states that reduction of strength and modulus of concrete due to elevated temperatures may occur in PWR and BWR concrete and steel containments. The implementation of 10 CFR 50.55a and ASME Code Section XI, Subsection IWL would not be able to identify the reduction of strength and modulus of concrete due to elevated temperature. Subsection CC-3400 of ASME Code Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long-term period. The GALL Report recommends further evaluation of plant-specific AMPs if any portion of the concrete containment components exceeds specified temperature limits (*i.e.*, general area temperature greater than 60 °C (150 °F) and local area temperature greater than 93 °C (200 °F)).

The staff determined through discussions with the applicant's technical personnel that, due to the absence of these aging mechanisms, the reduction of strength and modulus for concrete structures due to elevated temperature are not plausible aging effects. The applicant stated that aging effects due to elevated temperature are not anticipated for the concrete of the PNPS Mark I steel containment as general areas temperatures within the primary containment do not exceed 150°F and local area temperatures do not exceed 200°F. The staff determined that these aging effects are not applicable to the PNPS containment.

On the basis that there are no components from this group, the staff concludes that this aging effect is not applicable.

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.

LRA Section 3.5.2.2.1.4 states that containment is a Mark I steel containment located within the reactor building. The reactor building concrete in contact with the drywell shell is designed in accordance with specification ACI 318-63, "Building Code Requirements for Reinforced Concrete," and meets requirements of later guide ACI 201.2R-77 as both documents use the same ASTM standards for concrete selection, application, and testing. Concrete is monitored for cracks by the Structures Monitoring Program. The drywell steel shell and the area where the drywell shell becomes embedded in the drywell concrete floor are inspected by the Containment Inservice Inspection (IWE) Program and Structures Monitoring Program.

The LRA states that the drywell concrete floor was chipped out at several locations to expose the drywell shell below floor level and no evidence of corrosion was found. UT examinations of the drywell shell indicated no significant wall reduction. To prevent corrosion of the lower part of the drywell shell, the interior and exterior surfaces are protected from contact with the atmosphere by complete concrete encasement. Ground water cannot reach the drywell shell, assuming a crack in the concrete, as the concrete at this location is more than 8 feet thick and poured in multiple horizontal planes. The sand cushion area is drained at the sand cushion interface to protect the exterior surface of the drywell shell from water that might enter the air gap. Therefore, significant corrosion of the drywell shell is not anticipated.

SRP-LR Section 3.5.2.2.1.4 states that loss of material due to general, pitting, and crevice corrosion may occur in steel elements of accessible and inaccessible areas for all types of PWR and BWR containments. The existing program relies on ASME Code Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, 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.

For loss of material due to general, pitting, and crevice corrosion of carbon steel for drywell, torus, drywell head, embedded shell and sand pocket regions, drywell support skirt, torus ring girder, downcomers, liner plate, ECCS suction header, support skirt, region shielded by diaphragm floor, and suppression chamber exposed to indoor uncontrolled air or treated water, the GALL Report recommends programs consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE," and GALL AMP XI.S4, "10 CFR Part 50, Appendix J."

However, the applicant manages loss of material of the carbon steel drywell head, drywell shell, drywell sump liner, drywell to torus vent system, torus manway, torus ring girder, torus shell, and torus thermowell exposed to environments protected from weather using the Containment Inservice Inspection Program and the Containment Leak Rate Program.

The staff's evaluation of the Containment Inservice Inspection Program is documented in SER Section 3.0.3.3.2. The Containment Inservice Inspection Program encompasses the ASME Code Section XI, Subsection IWE requirements for managing loss of material for the primary containment and its attachments. Also, the applicant manages loss of material of the carbon steel drywell sump liner, torus ring girder, and torus shell exposed to a fluid environment using the Containment Inservice Inspection Program and the Containment Leak Rate Program.

Because the Containment Inservice Inspection Program requirements for inspection and detection of loss of material for the primary containment and attachments are the same as those of ASME Code Section XI, Subsection IWE, the staff found it an acceptable aging management program for loss of material for carbon steel components.

During the audit and review, the staff asked the applicant how it compares to Interim Staff Guidance document (ISG)-2006-01, "Plant-Specific Aging Management Program for Inaccessible Areas of Boiling Water Reactor Mark I Steel Containment Drywell Shell," proposal actions. In a letter dated January 29, 2007, the applicant stated that the coating specified for the drywell shell exterior surface is an alkyd-base primer (red lead or zinc chromate). No degradation of this coating in the sand cushion area was noted in 1987 when fiberscopes examined the 4-inch annulus air gap drain lines. So the drywell shell exterior remains dry during RFOs, the drywell to reactor building bellows assembly separates the refueling cavity filled with water from the exterior surface of the drywell shell. Any leakage through the bellows assembly is directed to a drain system (refueling bellows seal trough drains) equipped with an alarm to notify operators.

The applicant also stated that there has been no observed leakage causing moisture in the vicinity of the sand cushion and no moisture has been detected or suspected on the inaccessible areas of the drywell shell. Further, any potential leakage through the refueling bellows assembly is directed to a drain system. Therefore, no additional components require AMR for a source of moisture that might affect the drywell shell in the lower region. As stated in response to GL 87-05, the applicant took UT thickness measurements of the drywell shell in January 1987 at 12 locations directly above the sand cushion region and detected no loss of wall thickness. In 1987, access holes were machined in the drain line elbows (all four drain lines) for access for remote visual examination by fiberscope. This inspection found the four annulus air gap drains unobstructed with no signs of corrosion on the visible portions of the drywell surface. The applicant monitors the annulus air gap drains during every RFO in accordance with plant procedures.

The applicant took additional UT thickness measurements adjacent to the sand cushion region at the 9-foot, 1-inch elevation in 1999 and 2001. The sand cushion region of the drywell shell is inaccessible unless concrete is removed. For the examination in 1999 and 2001, concrete at the periphery of the 9-foot, 2-inch elevation was chipped away for UT wall thickness measurements of the drywell shell at the level of the upper sand cushion. The readings indicated that the drywell wall thickness in these areas is essentially as-built; however, the applicant removed UT thickness measurements in the sand cushion region from the IWE program after the 2001 outage cited the following:

1. Satisfactory results of leakage monitoring from the annulus air gap drains.

2. Satisfactory drywell wall thickness at the 9-foot, 1-inch elevation after 27 years of operation (as of 1999).

3. High radiation in areas of sand cushion UT exams.

4. Potential damage to the drywell shell from concrete removal tools.

In the same letter, the applicant stated under "Ongoing Actions to Prevent Drywell Corrosion" that the following ongoing actions would prevent and detect drywell corrosion:

1. PNPS monitors the four annulus air gap drains twice every RFO, once after flood-up and again before flood-down at the end of the outage. Leakage has never been detected from the annulus air gap drains at PNPS.

2. Functional checks are performed each RFO on the flow switch associated with the bellows seal leakage monitoring system.

3. Drywell interior surfaces are examined every RFO for degradation as required by Technical Specification 4.7.A.2.d. Additionally, drywell interior surfaces are examined in every other outage by the IWE Program. Drywell structures are examined in accordance with ASME Code Section XI, 1998 Edition with 2000 Addenda, Subsection IWE requirements for Class MC and metallic liner of Class CC components of light water cooled plants. Since IWE requirements were mandated in 1996, no areas exceeding code acceptance criteria have been detected on the drywell interior surfaces during these inspections.

4. PNPS inspects the liner drains for the water reservoirs on the refuel floor (*e.g.*, spent fuel pool, dryer/separator pool, and the reactor cavity) for leakage that could be a precursor for water leaks which could wet the drywell shell exterior surface. The applicant examines these drains for leakage after filling the refueling cavity.

5. Paragraph IWE-1242 of the ASME Code, Section XI, states that the surface areas likely to experience accelerated degradation and aging require augmented examinations included in the Inservice Inspection Program along with other containment examinations. The IWE requirements for augmented examination are required by 10 CFR 50.55a.

6. UT thickness examinations will continue under the IWE program at two locations in the upper drywell immediately adjacent to the fuel pool due to the potential for leakage from the fuel pool liner.

7. The drywell shell to floor joint is inspected by the IWE program.

In conclusion, the applicant stated:

> PNPS has effectively addressed the issue of drywell shell corrosion through actions taken in response to GL 87-05 as well as additional actions subsequent to the response to GL 87-05. UT examinations to determine the drywell wall thickness at the sand cushion region and upper drywell indicated no detectable loss of material and hence no discernable corrosion rate. Based on this corrosion rate, no discernable loss of drywell shell thickness is projected through the period of extended operation. The above described ongoing actions to prevent drywell

shell degradation provide continuing reasonable assurance of satisfactory drywell shell condition through the period of extended operation.

The staff evaluated this information and the information provided to the NRC aging management inspection staff on the status of the drywell shell and made the following findings:

- Operating experience confirms no indication of water in the air gap between the shell and the shield concrete. In addition, no leakage has been found through the refueling bellows into the area monitored by the air gap leakage detection system. Functional checks are performed each refueling outage on the flow switch for this leakage alarm system.
- The four annulus air gap drains are monitored twice every outage, after flood-up and prior to flood-down at the end of the outage. The applicant inspects the liner drains for the water reservoirs on the refuel floor (*e.g.*, spent fuel pool, dryer/separator pool and reactor cavity) for leakage that could be a precursor for water leaks that could wet the drywell shell exterior surface. The applicant examines these drains for leakage after filling the refueling cavity through operator tour observations
- UT thickness examinations will continue under the applicant's IWE program at two locations in the upper drywell immediately adjacent to the fuel pool due to the potential for leakage from the fuel pool liner.

In LRA Section B.1.16.1, Containment Inservice Inspection Program, the applicant stated: "CII inspections during RFO 15 (April 2005) did not reveal evidence of loss of material. Absence of degradation provides evidence that the program is effective for managing aging effects." In addition, in a letter dated January 29, 2007, under Ongoing Actions to Prevent Drywell Corrosion, the applicant states: "Functional checks are performed each refueling outage on the flow switch associated with the bellows seal leakage monitoring system." However, recent inspection team observations indicated that:

- The flow switch in the bellows rupture drain failed its surveillance in December 2005 and has not been fixed or evaluated. In addition, the flow switch also failed in 1999.
- Monitoring of other drains has been inconclusive and not well documented.
- The torus room floor has had water on the floor on multiple occasions.

In RAI B.1.16.1 dated November 7, 2006, the staff asked the applicant to address the above findings and discuss its impact on the aging management of potential loss of material due to corrosion in the inaccessible area of the Mark I steel containment drywell shell, including the sand pocket region, for the period of extended operation. This was identified as OI 3.0.3.3.2 in the SER with OI issued in March 2007.

> In its response dated March 13, 2007, the applicant stated that on December 28, 2005 the flow switch in the bellows rupture drain (FS-4803) failed to respond acceptably during testing. The water normally flows into the flow switch, actuates the switch, and discharges to the radwaste system. The failure was caused by blockage of the passages around the perimeter of the baffle of the flow switch. On November 17, 2006, the flow switch was replaced with a new switch and the drain functionally tested. The flow switch indicates rupture of the refueling bellows seal when the refueling cavity is full of water during refueling operations. The last time

the cavity was filled was during the refueling outage ending in May 2005. PNPS operates on a two-year refueling cycle, hence the next time the refueling cavity will be filled is in the spring of 2007. During the period from discovery of the FS-4803 failure to respond until replacement with the new switch in November 2006, there was no potential for undetected leakage since no water was present above the refueling bellows seal. A preventive maintenance task was established to replace flow switch FS-4803 every 15 years. Functional checks of the flow switch in the bellows rupture drain (FS-4803) are performed prior to each refueling outage and the switch is repaired, if necessary. Temporary failure of FS-4803 had no impact on the aging management of the inaccessible areas of the Mark I steel containment drywell shell.

In a letter dated May 1, 2007, the applicant included a torus room concrete basemat evaluation report from an Entergy consultant. With regard to the issue of water on the torus room floor, the report stated:

1. The groundwater migration through the 8ft. thick Reactor Building base mat is a highly localized phenomenon. It is caused by a 25ft hydraulic head difference, pushing groundwater through vertical joints and zones most likely weakened by tensions generated during setting and hydration following the construction. These localized zones are discontinuities equivalent to a vertical cylindrical hole of a maximum diameter of 4 mm (1/6 in). Such small discontinuities that originate from construction joints are inevitable in large-scale concrete engineering operations.

2. This highly localized nature of the zones through which water penetrates, does not compromise the overall structural performance of the Torus base mat: it does neither affect the bulk integrity of the concrete slab, nor the overall compressive and bending load bearing capacity of the reactor foundation.

3. Calcium leaching of the solid concrete is expected to take place in the localized zones through which water penetrates. While this localized calcium leaching does not affect the overall structural performance of the slab, it may contribute to further weakening the construction joints, and may eventually have degraded the grout in the annular space between the 3 in diameter hole and the 2 in diameter Williams rock anchors. A close-up inspection of the grout and bolt is recommended.

4. The lower pH-value of 9.3-9.4 of the water emerging from localized zones along the construction joints, compared to the typical pH-12 of concrete's bulk pore solution, is consistent with the calcium leaching observation. Its localized occurrence does not compromise the corrosion protection of the steel reinforcement in the slab. A refined corrosion indicator analysis is recommended to confirm the prevention or minimization of reinforcement and anchor bolt corrosion.

5. Changes in environmental conditions (e.g., seasonal changes in water table or a seismic event) that affect the static head that drives the water migration through the concrete would impact the rate of water seepage into the torus room. These affects [*sic*] would be small since, as discussed in the report, the discontinuities in the concrete base mat that are allowing the water seepage into the torus room are very small. Even if the current very low rate of water intrusion increased by an

order of magnitude because of a change in static head there would be no impact on plant safety due to the large size of the torus room.

In a letter dated May 1, 2007, the applicant indicated that commitments 43, 45 and 46 will be implemented to address this issue. Commitment 43 includes provisions for testing groundwater aggressiveness within the Structures Monitoring Program. Commitment 46 states:

> Inspect the condition of a sample of the torus hold-down bolts and associated grout and determine appropriate actions based on the findings prior to the period of extended operation.

In a letter dated May 17, 2007, Commitment 45 was revised to state:

> If groundwater continues to collect on the Torus Room floor, obtain samples and test such water to determine its pH and verify the water is non-aggressive as defined in GALL Report Section III.A1 item III.A.1-4 once prior to the period of extended operation and once every five years during the period of extended operation.

The applicant stated that it had established a new preventive maintenance task to replace the flow switch and will continue functional checks each refueling outage; described the monitoring and documentation of the bellows rupture drain and other drains; identified the source of water on the torus floor as groundwater that has no relation to the failed flow switch and drain monitoring inspection findings and has no impact on drywell shell corrosion in general; showed that water intrusion into the torus room will not detrimentally affect the structure; and, identified monitoring programs that both inspect torus bolts and test water for aggressiveness. The staff finds the applicant's actions acceptable and concludes that concerns identified in OI 3.0.3.3.2 have been resolved. OI 3.0.3.3.2 is closed.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.4. For those line items that apply to LRA Section 3.5.2.2.1.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

<u>Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature</u>. LRA Section 3.5.2.2.1.5 states that loss of prestress of concrete containments is not applicable to the Mark I steel containment. The staff finds this evaluation acceptable in that this aging effect is not applicable to the applicant's Mark I steel containment.

<u>Cumulative Fatigue Damage</u>. LRA Section 3.5.2.2.1.6 states that fatigue is a TLAA as defined in 10 CFR 54.3, and TLAAs are evaluated in accordance with 10 CFR 54.21(c). The staff's evaluation of this TLAA is addressed separately in SER Section 4.6.

During the audit and review, the staff noted in LRA Table 3.5.2-1 (page 3.5-54) that Note E is assigned for the component torus shell with the aging effect of cracking fatigue, indicating consistency with the GALL Report material, environment, and aging effect but a different

AMP credited. The staff asked the applicant to explain Note E because the AMP shown for this line item is a TLAA and GALL Report Item II.B1.1-4 also specifies a TLAA.

In a letter dated July 19, 2006, the applicant revised LRA Table 3.5.2-1, (page 3.5-54), for structure and/or component/commodity of torus shell, aging effect cracking fatigue to specify Note A.

On the basis of its review, the staff found the applicant's response acceptable because the applicant adequately addressed the AEM, as recommended by the GALL Report.

The discussion column of LRA Table 3.5.1, item 3.5.1-9 states: "Not applicable. See Section 3.5.2.2.1.6." However, during the audit and review, the staff noted the following statement in LRA Section 3.5.2.2.1.6: "Fatigue TLAAs for the steel drywell, torus, and associated penetrations are evaluated and documented in Section 4.6." The components in LRA Table 3.5.1, item 3.5.1-9, are penetration sleeves, penetration bellows, suppression pool shell, and unbraced downcomers. The staff asked the applicant to explain why item 3.5.1-9 is not applicable after a fatigue TLAA for the torus and penetrations and why the vent line, vent header, and vent line bellows are not listed in LRA Sections 3.5.2.2.1.6 and 4.6, as referenced in LRA Table 3.5.1, item 3.5.1-8.

In a letter dated July 19, 2006, the applicant supplemented the LRA to reflect the following changes:

> Fatigue analyses have been evaluated for the torus, drywell to torus vent system, and torus penetrations. The following line for the torus penetrations is added to Table 3.5.2-1: "Torus mechanical penetrations // PB, SSR // Carbon steel // Protected from weather // Cracking // TLAA-metal fatigue // II.B4-4 (c)-13) // 3.5.1-9 // A."

The evaluation of the drywell to torus vent system fatigue analysis determined that it was not a TLAA. The significant contributor to fatigue of the vent system is post-LOCA chugging, a one plant-life event. As there still will be only one design-basis LOCA for the life of the plant, including the period of extended operation, this analysis is not based on a time-limited assumption and is not a TLAA because fatigue for the vent system is event-driven and not an age-related effect.

The discussion column entry for LRA Table 3.5.1, item 3.5.1-8, is changed as follows:

> Fatigue analysis is a TLAA for the torus shell. Fatigue for the vent system is event-driven and the analysis is not a TLAA. See Section 3.5.2.2.1.6.

The discussion column entry for LRA Table 3.5.1, item 3.5.1-9, is changed as follows:

> Fatigue analysis is a TLAA for the torus penetrations. See Section 3.5.2.2.1.6.

Section 3.5.2.2.1.6 is changed to read as follows:

> TLAA are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4 of the application. Fatigue TLAAs for the torus and associated penetrations are evaluated as documented in Section 4.6.

On the basis of its review, the staff found the applicant adequately addressed the AEM, as recommended by GALL Report.

Cracking Due to Stress Corrosion Cracking. The staff reviewed LRA Section 3.5.2.2.1.7 against the criteria in SRP-LR Section 3.5.2.2.1.7.

LRA Section 3.5.2.2.1.7 states that the GALL Report recommends further evaluation of inspection methods to detect cracking due to SCC because visual VT-3 examinations may be unable to detect this aging effect. Potentially susceptible components are penetration sleeves and bellows.

The LRA states that SCC becomes significant for SS with tensile stresses and a corrosive environment. The stresses may be applied (external) or residual (internal). The normal environment inside the drywell is dry. The penetration components are not exposed to corrosive environments; therefore, SCC is not an AERM for the penetration sleeves and bellows since the conditions necessary for SCC do not exist.

SRP-LR Section 3.5.2.2.1.7 states that cracking due to SCC of SS penetration sleeves, penetration bellows, and DSM welds may occur in all types of PWR and BWR containments. Cracking due to SCC could also occur in SS vent line bellows for BWR containments. The existing program relies on ASME Code Section XI, Subsection IWE and 10 CFR Part 50, Appendix J, to manage this aging effect. The GALL Report recommends further evaluation of additional appropriate examinations/evaluations implemented to detect these aging effects for SS penetration sleeves, penetration bellows and DSM welds, and SS vent line bellows.

During interviews with the staff, the applicant's personnel stated that the GALL Report programs involve visual inspection and leak rate testing, which are not optimum methods for managing SCC. Therefore, when possible, the "other" method which may detect cracking is the existing Containment Leak Rate Program and, when necessary, augmented ultrasonic exams, the optimum method for managing SCC. As stated in LRA Section 3.5.2.2.1.7, SCC is not an aging effect requiring management for the penetration sleeves and bellows since the conditions necessary for SCC do not exist; however, the components are evaluated for aging effects (*e.g.*, cracking requiring management as shown in LRA Table 3.5.2-1).

Based on the above discussion, the staff found that the applicant has identified IWE as capable of detecting leaks caused by SCC. In addition, additional materials will not meet the necessary combinations of material and environment required to produce SCC.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.7 for further evaluation. For those line items that apply to LRA Section 3.5.2.2.1.7, 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 Cyclic Loading. The staff reviewed LRA Section 3.5.2.2.1.8 against the criteria in SRP-LR Section 3.5.2.2.1.8.

LRA Section 3.5.2.2.1.8 states that cyclic loading can lead to cracking of penetration sleeves, penetration bellows, and torus pool steel. If there is no CLB analysis, further evaluation is recommended of inspection methods to detect cracking due to cyclic loading because visual VT-3 examinations may be unable to detect this aging effect.

The analysis of cracking due to cyclic loading of the drywell, torus, and penetrations is a TLAA evaluated as documented in LRA Section 4.6.

SRP-LR Section 3.5.2.2.1.8 states that cracking due to cyclic loading of suppression pool steel and SS shells (including welded joints) and penetrations (including penetration sleeves, DSM welds, and penetration bellows) may occur in all types of PWR and BWR containments and BWR vent header, vent line bellows and downcomers. The existing program relies on ASME Code Section XI, Subsection IWE and 10 CFR Part 50, Appendix J, to manage this aging effect. However, VT-3 visual inspection may not detect fine cracks. The GALL Report recommends further evaluation for detection of this aging effect.

For cracking due to cyclic loading of steel, SS and DSM welds for penetration sleeves, penetration bellows, suppression pool shell, and unbraced downcomers exposed to indoor uncontrolled or outdoor air, the GALL Report recommends programs consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE," and GALL AMP XI.S4, "10 CFR Part 50, Appendix J."

However, the applicant manages cracking due to cyclic loading of the carbon steel primary containment mechanical penetrations (including those with bellows) exposed to environments protected from weather using the Containment Inservice Inspection Program and the Containment Leak Rate Program.

The staff's evaluation of the Containment Inservice Inspection Program is documented in SER Section 3.0.3.3.2. The Containment Inservice Inspection Program encompasses the ASME Code Section XI, Subsection IWE requirements for managing cracking of the primary containment and its attachments.

Because the Containment Inservice Inspection Program requirements for inspection and detection of cracking for the primary containment and its integral attachments are the same as those of ASME Code Section XI, Subsection IWE, the staff found it an acceptable management program for cracking of the primary containment mechanical penetrations (including those with bellows).

For cracking due to cyclic loading of steel, SS and DSM welds for torus, vent line, vent header, vent line bellows, and downcomers exposed to indoor uncontrolled air, the GALL Report recommends programs consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE," and GALL AMP XI.S4, "10 CFR Part 50, Appendix J."

However, the applicant manages cracking due to cyclic loading of the SS drywell to torus vent line bellows exposed to environments protected from weather using the Containment Inservice Inspection Program and the Containment Leak Rate Program.

The staff's evaluation of the Containment Inservice Inspection Program is documented in SER Section 3.0.3.3.2. The Containment Inservice Inspection Program encompasses the ASME Code Section XI, Subsection IWE requirements for managing cracking of the primary containment and its attachments. The staff's evaluation of the Containment Leak Rate Program is documented in SER Section 3.0.3.1.2. The Containment Leak Rate Program encompasses the 10 CFR Part 50, Appendix J.

Because the Containment Inservice Inspection Program requirements for inspection and detection of cracking for the primary containment and its integral attachments are the same as those of ASME Code Section XI, Subsection IWE, the staff found it an acceptable management program for cracking of the drywell to torus vent line bellows.

On the basis of its review, the staff found that the applicant adequately addressed the AEM, as recommended by the GALL Report.

During the audit and review, the staff noted that in LRA Table 3.5.2-1 (page 3.5-51), for component bellows (RV and drywell), one of the AMPs shown is the plant-specific Containment Inservice Inspection – IWE Program. A Note C is assigned to this AMR line item, and the component is different from but consistent with material, environment, aging effect, and AMP for the GALL Report line item. The AMP is consistent with the GALL AMP description. The staff asked the applicant to explain how the LRA line item bellows are different from the GALL Report Table 1 Item 3.5.1-13 bellows and how the plant-specific Containment Inservice Inspection – IWE AMP is consistent with the GALL AMP.

In a letter dated July 19, 2006, the applicant stated that Note C was assigned incorrectly to this line of LRA Table 3.5.2-1. The correct note for this line is Note E.

On the basis of its review, the staff found the response acceptable. The applicant adequately addressed the AEM, as recommended by the GALL Report.

The discussion column of LRA Table 3.5.1, items 3.5.1-12 and 3.5.1-13 does not refer to LRA Section 3.5.2.2.1.8 for further evaluation. During the audit and review, the staff asked the applicant to explain why this link was not made to the further evaluation section to explain the need for augmented ultrasonic exams to detect fine cracks with a CLB fatigue analysis available.

In its response dated July 19, 2006, the applicant revised LRA Table 3.5.1, items 3.5.1-12 and 3.5.1-13, to add a statement, "See Section 3.5.2.2.1.8," in the discussion column.

LRA Section 3.5.2.2.1.8 is revised to include the following statement:

> Cyclic loading can lead to cracking of steel and stainless steel penetration bellows, and DSM welds of BWR containments and BWR suppression pool shell and downcomers.

Cracking due to cycle loading is not anticipated in the drywell, torus, its penetration bellows, penetration sleeves, unbraced downcomers, and DSM welds. Plant-specific operating experience revealed no cracking of the components, and primary containment leakage has not been a concern. Nonetheless, the Containment Inservice Inspection (IWE), the existing Containment Leak Rate Program, and, when necessary, augmented ultrasonic exams will continue for detection of cracking. Observed conditions with the potential for impacting an intended function are evaluated or corrected in accordance with the corrective action process. The Containment Inservice Inspection and Containment Leak Rate programs are described in Appendix B.

The staff found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.8 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.8. For those line items that apply to LRA Section 3.5.2.2.1.8, the staff 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).

Loss of Material (Scaling, Cracking, and Spalling) Due to Freeze-Thaw. LRA Section 3.5.2.2.1.8 states that loss of material due to freeze-thaw of concrete containments is not applicable to its Mark I steel containment. The staff finds this evaluation acceptable in that this aging effect is not applicable to the applicant's Mark I steel containment.

Cracking Due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide. LRA Section 3.5.2.2.1.8 states that cracking due to expansion and reaction with aggregates of concrete containments is not applicable to its Mark I steel containment. The staff finds this evaluation acceptable in that this aging effect is not applicable to the applicant's Mark I steel containment.

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

The staff reviewed LRA Section 3.5.2.2.2 against SRP-LR Section 3.5.2.2.2 criteria, which address several areas:

Aging of Structures Not Covered by Structures Monitoring Program. The staff reviewed LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1.

LRA Section 3.5.2.2.2.1 addresses various aging effects of concrete and steel elements not covered by the Structures Monitoring Program due to various aging mechanisms. The LRA states that concrete structures subject to AMR are included in the Structures Monitoring Program. This statement is true for concrete items even if the AMR specified no AERMs. Aging effects for structural steel items are also managed 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 drywell, RPV support shoes for PWR with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The existing program relies on the structures monitoring program or 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 LRA states that the aging mechanisms of cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel apply to only below-grade concrete/grout structures. The below-grade environment is nonaggressive, and concrete is designed in accordance with specification ACI 318-63, "Building Code Requirements for Reinforced Concrete," for low permeability and resistance to aggressive chemical solutions by high-cement, low water-cement ratio (between 0.44 and 0.60), proper curing, and adequate air content between 3 percent and 6 percent. Therefore, cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not AERMs for Groups 1-5, 7, and 9 structures.

The staff determined through discussions with the applicant's technical personnel that the cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for Groups 1-5, 7, and 9 structures are not plausible aging effects due to the lack of aggressive groundwater (pH 6.2 greater than 5.5; chlorides 420 ppm less than 500 ppm; sulfates 16 ppm less than 1500 ppm), and concrete designed in accordance with specification ACI 318-63 with a high-cement, low water-cement ratio, proper curing, and adequate air content between 3 and 6 percent. However, the applicant includes these aging effects for such groups within the Structures Monitoring Program.

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 LRA states that the aging effect of the increased porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack for Groups 1-5, 7, and 9 structures is not applicable. Aggressive chemical attack becomes significant to concrete exposed to an aggressive environment. Resistance to mild acid attack is enhanced by a dense concrete with low permeability and low water-cement ratio of less than 0.50. These groups of structures have a dense, low-permeable concrete with a maximum water-cement ratio of 0.48 for an acceptable degree of protection against aggressive chemical attack. Water chemical analysis results confirm that the site groundwater is nonaggressive. The applicant's concrete is constructed in accordance with ACI 201.2R-77 recommendations for durability.

The LRA states that the site below-grade environment is nonaggressive. Therefore, increased porosity and permeability cracking and loss of material (spalling, scaling) due to aggressive chemical attack are not AERMs for Groups 1-5, 7, and 9 concrete structures.

The staff determined through discussions with the applicant's technical personnel that increased porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack for Groups 1-5, 7, and 9 structures are not plausible aging effects due to the lack of aggressive groundwater and concrete constructed in accordance with ACI 201.2R-77 recommendations for durability. However, the applicant includes these aging effects for such groups within the Structures Monitoring Program.

3. Loss of Material Due to Corrosion for Groups 1-5, 7, and 8 Structures

The LRA states that the aging effect of for the loss of material due to corrosion for Groups 1-5, 7, and 8 structures applies and that the Structures Monitoring Program manages AERMs for Groups 1-5, 7, and 8 structures.

The staff determined through discussions with the applicant's technical personnel that the loss of material due to corrosion for Groups 1-5, 7, and 8 structures is an aging effect which will be managed by the Structures Monitoring Program.

4. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1-3, 5, and 7-9 Structures

The LRA states that the aging effect of loss of material (spalling, scaling) and cracking attributed to freeze-thaw for Groups 1-3, 5, and 7-9 structures is not applicable. Aggregates were within specifications and materials conformed to ACI and ASTM standards. The applicant's structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water-cement ratios are within ACI 318 limits and air entrainment percentages within the range prescribed in the GALL Report. Therefore, loss of material (spalling, scaling) and cracking due to freeze-thaw are not AERMs for PNPS Groups 1-3, 5, and 7-9 structures.

The staff determined through discussions with the applicant's technical personnel that the loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, and 7-9 structures are not plausible aging effects due to concrete constructed in accordance with ACI and ASTM standards. However the applicant includes these aging effects for such groups within the Structures Monitoring Program.

5. Cracking Due to Expansion and Reaction with Aggregates for Groups 1-5 and 7-9 Structures

The LRA states that the aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction in accordance with ACI 201.2R-77 recommendations for concrete durability. The applicant's structures are constructed of a dense, durable mixture of sound, coarse aggregate, fine aggregate, cement, water, and admixture. Water-cement ratios are within ACI 318-63 limits and air entrainment percentages are within the range prescribed in the GALL Report. Therefore, cracking due to expansion and reaction with aggregates for Groups 1-3, 5, and 7-9 structures is not an AERM for PNPS concrete.

The staff determined through discussions with the applicant's technical personnel that the cracking due to expansion and reaction with aggregates for Groups 1-5 and 7-9 structures are not plausible aging effects due to concrete constructed in accordance with ACI and ASTM standards with a high-cement, low water-cement ratio. However, the applicant includes these aging effects for such groups within the Structures Monitoring Program.

6. Cracks and Distortion Due to Increased Stress Levels from Settlement for Groups 1-3 and 5-9 Structures

The LRA states that the Groups 1-3 and 5-9 structures are founded on dense to very dense silty sand and sand and gravel. No significant settlement has occurred since construction, and additional settlement is not anticipated. Therefore, cracks and distortion due to increased stress levels from settlement for Groups 1-3 structures are not aging mechanisms for concrete.

The staff determined through discussions with the applicant's technical personnel 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 due to the absence of these aging mechanisms. The applicant states that the aging effects due to settlement are not anticipated for Groups 1-3 and 5-9 Class 1 structures. Class 1 structures are founded on sound bedrock or supported by steel pilings which prevent significant settlement. The staff determined that these aging effects are not applicable to Class 1 structures. On the basis that there are no components from this group, the staff found this aging effect not applicable.

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 LRA states that structures are not constructed of porous concrete. Concrete was in accordance with ACI 318-63 requirements for dense, well-cured, high-strength concrete with low permeability. Therefore, reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation are not AERMs for Groups 1-3 and 5-9 structures.

The staff determined through discussions with the applicant's technical personnel that reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures are not plausible aging effects due to the absence of these aging mechanisms. The applicant states that the aging effects of reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures are not applicable because there are no porous concrete subfoundations of concern below these structures. The staff determined that these aging effects are not applicable to Groups 1-3 and 5-9 structures.

8. Lockup Due to Wear for Lubrite® Radial Beam Seats in BWR Drywell and Other Sliding Support Surfaces

The LRA states that, due to wear-resistant material, the low frequency (number of times) of movement, and the slow movement between sliding surfaces, lockup due to wear is not an AERM. However, Lubrite® plates are included within the Structures Monitoring Program and Inservice Inspection (ISI-IWF) Program to confirm the absence of AERMs for this component.

The staff determined through discussions with the applicant's technical personnel that the lockup due to wear for Lubrite® radial beam seats in BWR drywell and other sliding support surfaces is not a plausible aging effect due to wear-resistant material, the low frequency (number of times) of movement, and the slow movement between sliding surfaces. However the applicant includes these aging effects for Lubrite® drywell beam seat components within the Structures Monitoring Program.

The staff determined through discussions with the applicant's technical personnel that the applicant has included the eight structure/aging effect combinations in its Structures Monitoring Program, and no further evaluation is required by the GALL Report. However, although not required, the applicant has elected to evaluate each of the eight aging effects further. The staff found this additional evaluation acceptable.

The staff found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.1 for further evaluation.

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. LRA Section 3.5.2.2.2.2 addresses the following five items and states that concrete for Groups 1-3, 5, and 7-9 inaccessible concrete areas is in accordance with specification ACI 318-63, "Building Code Requirements for Reinforced Concrete," which requires the following for low permeability and resistance to aggressive chemical solution:

- high cement content
- low water permeability
- proper curing
- adequate air entrainment

The LRA states that PNPS concrete also meets the requirements of later guide ACI 201.2R-77, "Guide to Durable Concrete," as both documents use the same ASTM standards for concrete selection, application, and testing.

The LRA states that inspections of accessible concrete have revealed no degradation from corrosion of embedded steel. The site's below-grade environment is nonaggressive (pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1500 ppm). Therefore, corrosion of embedded steel is not an AERM for concrete.

The staff reviewed LRA Section 3.5.2.2.2.2 against the following SRP-LR Section 3.5.2.2.2.2 criteria:

(1) SRP-LR Section 3.5.2.2.2.2 states that loss of material (spalling, scaling) and cracking due to freeze-thaw may occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these groups of structures for plants located in moderate to severe weather conditions.

(2) SRP-LR Section 3.5.2.2.2.2.2 states that cracking due to expansion and reaction with aggregates may occur in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures. The GALL Report recommends further evaluation of inaccessible areas of these groups of structures for concrete not constructed in accordance with ACI 201.2R-77

recommendations.

(3) SRP-LR Section 3.5.2.2.2.2 states that cracks and distortion due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations may occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures. The existing program relies on structures monitoring program to manage these aging effects. Some plants may rely on a de-watering system to lower the site ground water 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 included within the scope of the applicant's structures monitoring program.

(4) SRP-LR Section 3.5.2.2.2.2 states that increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel may occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas of these groups of structures in aggressive environments.

(5) SRP-LR Section 3.5.2.2.2.2 states that increases in porosity and permeability, and loss of strength due to leaching of calcium hydroxide may occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these groups of structures for concrete not constructed in accordance with ACI 201.2R-77.

The staff determined through discussions with the applicant's technical personnel that the aging management of inaccessible areas due to aggressive chemical attack for Groups 1-5, 7, and 9 structures are not plausible aging effects due to the lack of aggressive groundwater (pH: 6.2, chlorides: 420 ppm, and sulfates: 16 ppm) and concrete constructed in accordance with ACI 201.2R-77 recommendations for durability with a high-cement, low water-cement ratio. In Commitment No. 43 dated January 16, 2007, the applicant revised the Structures Monitoring Program to include an engineering evaluation that will periodically conduct, at least once every five years, ground water samples to assess the aggressiveness on the concrete by monitoring for pH, chloride, and sulfate levels. There will be opportunistic inspections of inaccessible concrete areas when they become accessible under the Buried Piping Inspection Program and the Structures Monitoring Program. In a letter dated September 13, 2006, the applicant listed commitments. Commitment No. 25 will revise the Structures Monitoring Program to require opportunistic inspections of inaccessible concrete areas when they become accessible.

The staff found that, based on the programs identified and the commitment stated above, the applicant has met the criteria of SRP-LR Sections 3.5.2.2.2.2.1 through 3.5.2.2.2.2.5 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2. For those line items that apply to LRA Section 3.5.2.2.2.2, 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).

Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature. The staff reviewed LRA Section 3.5.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.3.

LRA Section 3.5.2.2.2.3 states that Groups 1-5 concrete elements do not exceed the temperature limits for aging degradation due to elevated temperature. Therefore, reduction of strength and modulus of concrete due to elevated temperatures is not an AERM.

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 Group 1-5 concrete structures. For any 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 increased temperatures not to exceed 200 °F. The GALL Report recommends further evaluation of a plant-specific program if any portion of the safety-related and other concrete structures exceeds specified temperature limits (*i.e.*, general area temperature greater than 66 °C (150 °F) and local area temperature greater than 93 °C (200 °F)).

The staff determined through discussions with the applicant's technical personnel that the reduction of strength and modulus of concrete structures due to elevated temperatures is not a plausible aging effect due to the absence of these aging mechanisms. The applicant stated that the aging effects due to elevated temperature are not anticipated for concrete of Groups 1-5 structures as general area temperatures within the primary containment do not exceed 150°F and local area temperatures do not exceed 200°F. The staff determined that these aging effects are not applicable to the PNPS Groups 1-5 structure concrete.

During the audit and review, the staff asked the applicant for the maximum temperatures that concrete experiences in Groups 1-5 structures.

During interviews with the staff, the applicant's technical personnel stated that they expect the concrete to experience an average general area temperature of 148°F (UFSAR Table 5.2-2). For structures outside the drywell, the bulk area maximum temperature is 120°F for Groups 1-5 structures as shown in UFSAR Table 10.9-2. Concrete within the drywell consists of the reactor pedestal, sacrificial shield wall, and the drywell floor. Assurance that bulk concrete temperatures within the drywell remain below 150°F is through maintenance of average bulk containment temperature within the limits of PNPS Technical Specification Section 3.2-H (page 3/4.2-5). Although upper elevations of the drywell may exceed 150°F, the concrete of the drywell is at a lower elevation. The drywell cooling system ensures that temperature limits are not exceeded. The highest concrete temperature in the drywell is at the sacrificial shield wall. The concrete in this wall is not load-bearing.

On the basis that elevated temperatures are not anticipated for the concrete structures of Groups 1-5 structures, the staff found this aging effect not applicable to PNPS.

Aging Management of Inaccessible Areas for Group 6 Structures. The staff reviewed LRA Section 3.5.2.2.2.4 against the following SRP-LR Section 3.5.2.2.2.4 criteria:

(1) LRA Section 3.5.2.2.2.4 states that below-grade exterior reinforced concrete is not exposed to an aggressive environment (pH less than 5.5), or to chloride or sulfate solutions beyond defined limits (greater than 500 ppm chloride, or greater than 1500 ppm sulfate). Therefore, increased porosity and permeability, cracking, loss of material (spalling, scaling)/aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel are not AERMs for below-grade inaccessible concrete areas of Group 6 structures.

SRP-LR Section 3.5.2.2.2.4 states that increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel may occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas in aggressive environments.

The staff determined through discussions with the applicant's technical personnel that increased porosity and permeability, cracking, loss of material (spalling, scaling)/aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel in below-grade inaccessible concrete areas of Group 6 structures are not significant aging effects due to the lack of aggressive groundwater (pH: 6.2, chlorides: 420 ppm, and sulfates: 16 ppm) and concrete constructed in accordance with ACI 201.2R-77 recommendations for durability with a high-cement, low water-cement ratio. In Commitment No. 43 dated January 16, 2007, the applicant revised the Structures Monitoring Program to include an engineering evaluation that will periodically conduct, at least once every five years, ground water samples to assess the aggressiveness on the concrete by monitoring for pH, chloride, and sulfate levels. There will be opportunistic inspections of inaccessible concrete areas when they become accessible under the Buried Piping Inspection Program and the Structures Monitoring Program. In a letter dated September 13, 2006, the applicant listed commitments. Commitment No. 25 will revise the Structures Monitoring Program to require opportunistic inspections of inaccessible concrete areas when they become accessible.

During the audit and review, the staff noted that the discussion column of LRA Table 3.5.1, item 3.5.1-34, does not refer to LRA Section 3.5.2.2.2.4(1) for further evaluation. During the audit and review, the staff asked the applicant to explain why this link was not made to the further evaluation section.

In response, the applicant stated that SRP-LR item 3.5.1-34 indicates that further evaluation is necessary only for aggressive environments. No reference was made to further evaluation in LRA Section 3.5.2.2.2.4(1) because the environment is nonaggressive, as noted in LRA Table 3.5.1, item 3.5.1-34, in the discussion column. For clarification, in its letter dated July 19, 2006, the applicant revised the LRA Table 3.5.1, item 3.5.1-34, discussion to add "See Section 3.5.2.2.2.4(1)."

The staff found that, based on the programs identified and the commitments above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4.1 for further evaluation.

(2) LRA Section 3.5.2.2.2.4 states that the aging effects of loss of material (spalling, scaling)

and cracking due to freeze-thaw in below-grade inaccessible concrete areas of Group 6 structures are not applicable because the aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction. PNPS structures are constructed of a dense, durable mixture of sound, coarse aggregate, fine aggregate, cement, water, and admixture. Water-cement ratios are within ACI 318 limits and air entrainment percentages are within the range prescribed in the GALL Report. Therefore, loss of material (spalling, scaling) and cracking due to freeze-thaw are not AERMs for Group 6 structures below grade and not continuously exposed to raw water. Group 6 concrete that may become saturated from continuous exposure to raw water of the Cape Cod Bay are conservatively considered susceptible to freeze-thaw and managed by the Structures Monitoring Program.

SRP-LR Section 3.5.2.2.2.4 states that loss of material (spalling, scaling) and cracking due to freeze-thaw may occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas for plants located in moderate to severe weather conditions.

The staff determined through discussions with the applicant's technical personnel that loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible concrete areas of Group 6 structures are not aging effects due to concrete constructed in accordance with ACI and ASTM standards with a high-cement, low water-cement ratio. Group 6 concrete that may become saturated from continuous exposure to raw water of Cape Cod Bay is conservatively considered susceptible to freeze-thaw and managed by the Structures Monitoring Program. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

During the audit and review, the staff noted that the discussion column of LRA Table 3.5.1, item 3.5.1-35 makes no reference to LRA Section 3.5.2.2.2.4(2) for further evaluation. During the audit and review, the staff asked the applicant to explain why this link was not made to the further evaluation section.

In a letter dated July 19, 2006, the applicant revised the LRA Table 3.5.1, item 3.5.1-35 discussion to add, "See Section 3.5.2.2.2.4(2)," and replaced the reference to "ACI-301" with "ACI 318."

The staff finds that, based on the programs identified above and in the July 19, 2006, letter, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4.2 for further evaluation.

(3) LRA Section 3.5.2.2.2.4 states that the aging effects of cracking due to expansion and reaction with aggregates, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide in below-grade inaccessible concrete areas of Group 6 structures are not applicable because the aggregates were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction in accordance with ACI 201.2R-77 recommendations for concrete durability. PNPS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Water-cement ratios are within ACI 318-63 limits and air entrainment percentages are within the range prescribed in the

GALL Report. The site's below-grade environment is nonaggressive (pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1500 ppm).

SRP-LR Section 3.5.2.2.2.4 states that cracking due to expansion and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide may occur in below-grade inaccessible reinforced concrete areas of Group 6 structures. The GALL Report recommends further evaluation of inaccessible areas for concrete not constructed in accordance with ACI 201.2R-77 recommendations.

The staff determined through discussions with the applicant's technical personnel that cracking due to expansion and reaction with aggregates and increased porosity and permeability due to leaching of calcium hydroxide in below-grade, inaccessible concrete areas of Group 6 structures is not an aging mechanism for PNPS concrete. The staff determined through discussions with the applicant's technical personnel that cracking due to expansion and reaction with aggregates, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide in below-grade inaccessible concrete areas of Group 6 structures are not aging effects due to concrete constructed in accordance with ACI and ASTM standards with a high-cement, low water-cement ratio and a nonaggressive below-grade environment. However the applicant includes these aging effects for this group within the Structures Monitoring Program.

During the audit and review, the staff noted that the discussion column of LRA Table 3.5.1, item 3.5.1-36, makes no reference to LRA Section 3.5.2.2.2.4 (3) for further evaluation. During the audit and review, the staff asked the applicant to explain why this link is not made to the further evaluation section, to clarify whether the statement, "See Section 3.5.2.2.2.1 (5) for additional discussion," is for Groups 1-5, 7, 9 as well as accessible Group 6 concrete, and to explain further why LRA Section 3.5.2.2.2.4 (3) lists cracking of concrete due to SCC.

In a letter dated July 19, 2006, the applicant revised the LRA Table 3.5.1, item 3.5.1-36 discussion as follows:

> Reaction with aggregates is not an applicable aging mechanism for PNPS concrete components. See Section 3.5.2.2.2.1(5) (although for Groups 1-5, 7, 9 this discussion is also applicable to Group 6) and Section 3.5.2.2.2.4(3) additional discussion. Nonetheless, the Structures Monitoring Program will confirm the absence of aging effects requiring management for PNPS Group 6 concrete components. The title of LRA Section 3.5.2.2.2.4(3) is revised to begin with "Cracking Due to Expansion and Reaction with Aggregates."

The staff found that, based on the programs identified above and in the July 19, 2006, letter, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4(3) for further evaluation.

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. The staff reviewed LRA Section 3.5.2.2.2.5 against the criteria in SRP-LR Section 3.5.2.2.2.5.

LRA Section 3.5.2.2.2.5 states that no tanks with SS liners are included in the structural AMRs. Tanks subject to AMR are evaluated with their respective mechanical systems.

SRP-LR Section 3.5.2.2.2.5 states that cracking due to SCC and loss of material due to pitting and crevice corrosion may occur for Groups 7 and 8 SS tank liners exposed to standing water. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects.

The staff determined through discussions with the applicant's technical personnel that cracking due to SCC and loss of material due to pitting and crevice corrosion are not AERMs because there are no tanks with SS liners in the structural AMRs. Tanks subject to an AMR are evaluated with their mechanical systems.

On the basis that there are no components from this group, the staff concluded that this aging effect is not applicable.

Aging of Supports Not Covered by 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.

LRA Section 3.5.2.2.2.6 states that the GALL Report recommends further evaluation of certain component support-aging effect combinations not covered by the applicant's Structures Monitoring Program. Component supports are included in the Structures Monitoring Program for Groups B2 through B5 and Inservice Inspection (ISI-IWF) Program for Group B1.

SRP-LR Section 3.5.2.2.2.6 states that the GALL Report recommends further evaluation of certain component support-aging effect combinations not covered by structures monitoring programs, including (1) loss of material due to general and pitting corrosion for Groups B2-B5 supports; (2) reduction in concrete anchor capacity due to degradation of the surrounding concrete for Groups B1-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements for Group B4 supports. Further evaluation is necessary only for structure-aging effect combinations not covered by the applicant's structures monitoring program.

1. Reduction in concrete anchor capacity due to degradation of the surrounding concrete for Groups B1 through B5 supports.

The LRA states that PNPS concrete anchors and surrounding concrete are in the Structures Monitoring Program (Groups B2 through B5) and Inservice Inspection (ISI-IWF) Program (Group B1).

2. Loss of material due to general and pitting corrosion for Groups B2 through B5 supports

The LRA states that loss of material due to corrosion of steel support components is an AERM at PNPS. This aging effect is managed by the Structures Monitoring Program.

3. Reduction/loss of isolation function due to degradation of vibration isolation elements for Group B4 supports

AMR indicates no component support structure-aging effect combination corresponding to GALL Report, Volume 2, Item III.B4-12.

The staff finds that the applicant has included these AEM combinations within the scope of its Structures Monitoring Program or Inservice Inspection (IWF) Program and agrees that no further evaluation is required. The staff determined through discussions with the applicant's technical personnel that reduction/loss of isolation function due to degradation of vibration isolation elements for Group B4 supports is not an AERM because there are no vibration isolation components within the scope of license renewal. The staff reviewed the applicant's Structures Monitoring Program and Inservice Inspection (IWF) Program, and these evaluations are documented in SER Section 3.0.3.2.17 and SER Section 3.0.3.3.3, respectively. The staff finds the applicant's Structures Monitoring Program and Inservice Inspection (IWF) Program acceptable for managing the AEM combinations of component supports for the GALL Report component support Groups B1 through B5 as those combinations apply.

During the audit and review, the staff noted that the discussion column of LRA Table 3.5.1, item 3.5.1-40 states:

> Plant experience has not identified reduction in concrete anchor capacity or other concrete aging mechanisms. Nonetheless, the Structures Monitoring Program will confirm absence of aging effects requiring management for PNPS concrete components.

The staff could not find an AMR line item in Table 2 for this component (building concrete at locations of expansion and grouted anchors; grout pads for support base plates). During the audit and review, the staff asked the applicant for the Table 2 number, LRA page number, and component where this AMR line item is evaluated.

In response the applicant stated that building concrete at locations of expansion and grouted anchors and grout pads for support base plates are shown as "foundation" and "Reactor vessel support pedestal" in LRA Table 3.5.2-1 (page 3.5-55); "foundation" in Tables 3.5.2-2 through 3.5.2-5 (pages 3.5-59, 3.5-61, and 3.5-64); and as "Equipment pads/foundations" in Table 3.5.2-6 (page 3.5-80). Further evaluation is in LRA Section 3.5.2.2.2.6(1), page 3.5-15. In its response dated July 19, 2006, the applicant revised the LRA Table 3.5.1, item 3.5.1-40 discussion for clarification to add "See Section 3.5.2.2.2.6(1)."

The staff found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.6 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.6. For those line items that apply to LRA Section 3.5.2.2.2.6, 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).

Cumulative Fatigue Damage Due to Cyclic Loading. LRA Section 3.5.2.2.2.7 states that for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3, this aging effect is not applicable. During the process of indicating TLAAs in the CLB, no fatigue analyses were indicated for these components.

The staff determined through discussions with the applicant's technical personnel that there are no CLB fatigue analyses for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 and, therefore, cumulative fatigue damage cannot be evaluated as an aging effect for these components. Therefore, cumulative fatigue damage for Groups B1.1, B1.2 and B1.3 component supports is not a TLAA as defined in 10 CFR 54.3.

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

The staff's evaluation of the applicant's QA program safety-related and nonsafety-related components is in SER Section 3.0.4.

3.5.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.5.2-1 through 3.5.2-6, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.5.2-1 through 3.5.2-6, the applicant indicated, via notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information 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.

Staff Evaluation. 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.

AEMs in Table 3.5.1 Not Applicable to PNPS. The staff reviewed LRA Table 3.5.1, which summarizes aging management evaluations for the SC supports evaluated in the GALL Report.

The LRA Table 3.5.1, item 3.5.1-19 discussion column states that the cracking of steel elements – SS suppression chamber shell (inner surface) – due to SCC is not applicable to PNPS.

The staff found that Table 3.5.1, item 3.5.1-19, is applicable to SS suppression chambers. The suppression chamber is carbon steel.

On the basis that there is no SS suppression chamber shell in the SC supports, the staff finds this aging effect not applicable to the component type.

The LRA Table 3.5.1, item 3.5.1-20 discussion column states that the loss of material of steel elements – suppression chamber liner (interior surface) – due to general, pitting, and crevice corrosion is not applicable to PNPS.

The staff found that Table 3.5.1, item 3.5.1-20, is applicable to concrete containments. The containment is a Mark I steel containment.

On the basis that there is no suppression chamber liner in the SC supports, the staff finds this aging effect not applicable to the component type.

The LRA Table 3.5.1, item 3.5.1-22 discussion column states that the loss of material of prestressed containment – tendons and anchorage components – due to corrosion is not applicable to PNPS.

The staff found that Table 3.5.1, item 3.5.1-22, is applicable to concrete containments. The containment is a Mark I steel containment without prestressed tendons.

On the basis that there are no tendons and anchorage components in the SC supports, the staff finds this aging effect not applicable to the component type.

The LRA Table 3.5.1, item 3.5.1-51 discussion column states that cracking and loss of material of Group B1.1 – high-strength, low-alloy bolts – due to stress corrosion and general corrosion is not applicable. SCC of high-strength anchor bolts is not an AERM for two reasons: (1) high-strength bolting is not exposed to a corrosive environment or high tensile stresses and (2) high-strength structural bolts are installed with friction-type contact surfaces via the turn-of-the-nut method; therefore, for bolts greater than 1 inch in diameter, a significant preload (in the order of 70 percent of ultimate strength) is not practical to develop. The Inservice Inspection (IWF) Program manages loss of material for high-strength low-alloy bolts.

The staff determined that cracking of high-strength low-alloy bolts due to stress corrosion will not occur for Group B1.1 components in the absence of a corrosive environment and high tensile stresses.

On the basis of the absence of the environment and high tensile stresses needed to cause cracking from SCC for high-strength low-alloy bolts in the SC supports, the staff finds this aging effect not applicable to the component type.

The LRA Table 3.5.1, item 3.5.1-52 discussion column states that the loss of mechanical function of Groups B2 and B4 – sliding support bearing and sliding support surfaces due to corrosion, distortion, dirt, overload, and fatigue due to vibratory and cyclic thermal loads – is not applicable and is not an aging effect requiring management. Proper design prevents distortion, overload, and fatigue due to vibratory and cyclic thermal loads.

During the audit and review, the staff asked the applicant to explain (1) how loss of mechanical function due to corrosion is not an aging effect needing management for the period of extended operation and (2) if proper design prevents distortion, overload, and fatigue due to vibratory and cyclic thermal loads, whether there has ever been a component failure due to any of these conditions, (3) whether there has ever been a component failure in the nuclear industry due to any of these conditions, and (4) where sliding support bearings and sliding support surfaces are component Groups B2 and B4 and to what environment are they exposed.

In response the applicant stated that loss of material due to corrosion is an aging effect that can cause a loss of intended function. Loss of mechanical function would be a loss of intended function. Loss of mechanical function is not an aging effect but the result of aging effects. There have been component failures in the industry due to distortion, overload, and excessive vibration. Such failures typically result from inadequate design or events rather than the effects of aging. Failures due to cyclic thermal loads are very rare for structural supports due to their relatively low temperatures.

The sliding surface material is Lubrite®, a corrosion-resistant material. Components are inspected under the Inservice Inspection (IWF) Program for torus saddle supports and the Structures Monitoring Program for the Lubrite® components of radial beam seats. There has been no plant-specific operating experience with failure of Lubrite® components in structural applications. There is no industry operating experience with failure of Lubrite® sliding surfaces. B2 grouping components are limited to the torus radial beam seats and support saddles. There are no sliding support surfaces for the B4 component grouping for sliding surfaces.

In a letter dated July 19, 2006, the applicant revised the LRA Table 3.5.1, item 3.5.1-52 discussion as follows:

> Loss of mechanical function due to the listed mechanisms is not an aging effect. Such failures typically result from inadequate design or operating events rather than from the effects of aging. Failures due to cyclic thermal loads are rare for structural supports due to their relatively low temperatures.

The staff determined that loss of mechanical function due to distortion, dirt, overload, and fatigue due to vibratory and cyclic thermal loads are not AERMs. Such failures typically result from inadequate design or events rather than the effects of aging.

On the basis that the mechanisms in LRA Table 3.5.1, item 3.5.1-52, other than corrosion, are not aging mechanisms which cause aging effects for Groups B2 and B4 components in the SC supports, the staff finds this aging effect not applicable to PNPS for the component type.

The LRA Table 3.5.1, item 3.5.1-54 discussion column states that the loss of mechanical function of Groups B1.1, B1.2, and B1.3 – constant and variable load spring hangers; guides and stops due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads – is not applicable and is not an aging effect requiring management. Proper design prevents distortion, overload, and fatigue due to vibratory and cyclic thermal loads.

During the audit and review, the staff asked the applicant to explain (1) how loss of mechanical function due to corrosion is not an aging effect needing management for the period of extended operation, (2) if proper design prevents distortion, overload, and fatigue due to vibratory and cyclic thermal loads, whether there has ever been a component failure due to any of these conditions, (3) whether there has ever been a component failure in the nuclear industry due to any of these conditions, and (4) what VT-3 visual examinations of Groups B1.1, B1.2, and B1.3 components inspect for under its Inservice Inspection Program during its current license and also anticipated VT-3 visual examinations during its possible extended license period.

In response the applicant stated that the discussion for item 3.5.1-54 does not say that failures have not occurred but that loss of mechanical function is not an aging effect. For license renewal, the applicant indicates a number of aging effects that can cause loss of intended function. Loss of intended function includes loss of mechanical function. The loss of function is not considered an aging effect. Aging effects that could cause loss of mechanical function for components in item 3.5.1-54 are addressed elsewhere in the AMRs. For example, loss of material due to any mechanism is addressed in Table 3.5.2-6 under listings for component and piping supports ASME Classes 1, 2, 3, and MC (page 3.5-71) and component and piping supports (page 3.5-72). Component failures at PNPS and in the nuclear industry certainly have occurred due to overload (typically caused by events like water hammer) or vibratory and cyclic thermal loads. Because of the low operating temperatures, failures due to cyclic thermal loads are extremely rare for structural commodities. Failures due to distortion or vibratory loads have also occurred due to inadequate design, but rarely, if ever, due to the normal effects of aging.

In a letter dated July 19, 2006, the applicant revised LRA Table 3.5.1, item 3.5.1-54, to state as follows:

> Loss of mechanical function due to distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads are not aging effects requiring management. Such failures typically result from inadequate design or events rather than the effects of aging. Loss of material due to corrosion, which could cause loss of mechanical function, is addressed under Item 3.5.1-53 for Groups B1.1, B1.2, and B1.3 support members.

The staff determined that loss of mechanical function due to distortion, dirt, overload, and fatigue due to vibratory and cyclic thermal loads are not AERMs. Such failures typically result from inadequate design or events rather than the effects of aging.

On the basis that the mechanisms in LRA Table 3.5.1, item 3.5.1-54, other than corrosion are not aging mechanisms which cause aging effects for Groups B1.1, B1.2, and B1.3 components in the SC supports, the staff finds this aging effect not applicable to the component type.

The LRA Table 3.5.1, item 3.5.1-57, discussion column states that the reduction or loss of isolation function of Groups B1.1, B1.2, and B1.3 (*i.e.*, vibration isolation elements due to radiation hardening, temperature, humidity, and sustained vibratory loading) is not applicable because there are no supports with vibration isolation elements within the scope of license renewal.

The staff found that the applicant has no Groups B1.1, B1.2, and B1.3 vibration isolation elements within the scope of license renewal.

On the basis that there are no Groups B1.1, B1.2, and B1.3 vibration isolation elements in the SC supports, the staff finds this aging effect not applicable to the component type.

SC Supports AMR Line Items With No Aging Effects (LRA Tables 3.5.2-1 through 3.5.2-6). LRA Tables 3.5.2-1 through 3.5.2-6 show AMR line items with no aging effects found in the aging review process. Specifically, the applicant states that no aging effects were found for components fabricated from concrete material exposed to protected-from-weather, weather, or fluid environments. The LRA states that inaccessible and accessible concrete areas are designed in accordance with ACI specification ACI 318-63, "Building Code Requirements for Reinforced Concrete," for low permeability and resistance to aggressive chemical solutions by requiring the following:

- high cement content
- low water-cement ratio
- proper curing
- adequate air entrainment

The LRA states that PNPS concrete also meets requirements of later guide ACI 201.2R-77, "Guide to Durable Concrete," as both ACI documents use the same ASTM standards for concrete selection, application, and testing. The below-grade environment is nonaggressive (pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1500 ppm). Concrete was with air content between 3 and 5 percent and, in general, a water-cement ratio between 0.44 and 0.60. Therefore, increased porosity and permeability due to leaching of calcium hydroxide, 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 are not applicable to concrete in accessible and inaccessible areas.

The LRA states that aggregates were in accordance with specifications and materials conforming to ACI and ASTM standards. PNPS concrete structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. Therefore, loss of material (spalling, scaling) and cracking due to freeze-thaw and cracking due to expansion and reaction with aggregates are not AERMs for PNPS structures. ASME Code, Section III, Division 2, Subsection CC, indicates that aging due to elevated temperature exposure is not significant as long as concrete general area temperatures do not exceed 150°F and local area temperatures 200°F. During normal operation, areas within the primary containment and other structures are within these temperature limits. Therefore, reduction of strength and modulus of concrete structures due to elevated temperature is not an AERM for concrete. However, the applicant has elected to confirm the absence of concrete aging effects by its Structures Monitoring Program.

The staff found that the quality of the reinforced concrete meets the codes and standards of the GALL Report and the concrete is not susceptible to the listed aging effects. The below-grade environment was found nonaggressive with groundwater monitoring continuing during the period of extended license. Therefore, no aging effects are applicable to components fabricated from concrete material protected from weather or exposed to weather or to fluid environments. However, the applicant will confirm the absence of concrete aging effects under its Structures Monitoring Program.

On the basis of its review, the staff found that concrete components protected from weather, exposed to weather, or exposed to fluid will not experience aging of concern during the period of extended operation. The staff finds the applicant's AMR evaluations of potential aging effects acceptable. Therefore, the staff concluded that there are no applicable AERMs for concrete components exposed to protected-from-weather, exposed-to-weather, or exposed-to-fluid environments.

LRA Tables 3.5.2-1 through 3.5.2-6 show AMR line items with no aging effects found in the aging review process. Specifically, the applicant states that no aging effects were found for components fabricated from Lubrite® plate material in environments protected from weather. The LRA states that Lubrite® plates for nuclear applications in the drywell beam seats and the torus support saddles are designed to resist deformation, have a low coefficient of friction, resist softening at elevated temperatures, resist corrosion, withstand high intensities of radiation, do not score or mar, and are not susceptible to AERMs. Due to the wear-resistant material, the low frequency (number of times) of movement, and the slow movement between sliding surfaces, lockup and loss of mechanical function of Lubrite® plates from wear, corrosion, distortion, dirt, overload, and fatigue due to vibratory and cyclic thermal loads are not AERMs. Nonetheless, Lubrite® plates are included within the Structures Monitoring Program and Inservice Inspection (IWF) Program. The staff found that industry operating experience and applicant inservice inspection inspections reports for slide-bearing plates have indicated no recordable degradation due to any aging effects. Therefore, no aging effects are applicable to components fabricated from Lubrite® plate material exposed to environments protected from weather.

On the basis of its review, the staff found that environments protected from weather will cause no aging of concern during the period of extended operation. The staff finds acceptable the applicant's AMR evaluation that Lubrite® plate in environments protected from weather will have no aging effects. Therefore, the staff concluded that there are no applicable AERMs for Lubrite® plate components exposed to environments protected from weather.

LRA Tables 3.5.2-1 through 3.5.2-6 show AMR line items with no aging effects found in the aging review process. Specifically, the applicant states that no aging effects were found for components fabricated from aluminum material in an exposed-to-weather environment.

The LRA states that the ambient environment is not chemically polluted by vapors of sulfur dioxide or similar substances and the external environment contains no saltwater or high chlorides. In this nonaggressive environment, the occasional wetting and drying from normal outdoor weather causes no significant loss of material for aluminum components. Therefore, loss of material due to pitting and crevice corrosion is not an AERM for aluminum components exposed to a weather environment. The staff found that industry operating experience supports the conclusion that there are no aging effects for aluminum in a weather environment. Therefore, no aging effects are applicable to components fabricated from aluminum material exposed to a weather environment.

On the basis of its review, the staff found that a weather environment on aluminum will not cause aging of concern during the period of extended operation. The staff finds acceptable the applicant's AMR evaluations that aluminum in a weather environment has no aging effects. Therefore, the staff concluded that there are no applicable AERMs for aluminum components exposed to weather environments.

LRA Tables 3.5.2-1 through 3.5.2-6 show AMR line items with no aging effects found in the aging review process. Specifically, the applicant states that no aging effects were found for components fabricated from SS material in environments exposed to weather.

The LRA states that the ambient environment is not chemically polluted by vapors of sulfur dioxide or similar substances and the external environment contains no saltwater or high chlorides. In this nonaggressive environment, the occasional wetting and drying from normal outdoor weather causes no significant loss of material for SS components. Therefore, loss of material due to pitting and crevice corrosion is not an AERM for SS components exposed to a weather environment. The staff found that industry operating experience supports the conclusion that there are no aging effects for SS in weather environments. Therefore, no aging effects are applicable to components fabricated from SS material exposed to weather environments.

On the basis of its review, the staff found that a weather environment on SS will not cause aging of concern during the period of extended operation at PNPS. The staff finds acceptable the applicant's AMR evaluations that SS in a weather environment has no aging effects. Therefore, the staff concluded that there are no applicable AERMs for SS components exposed to a weather environments at PNPS.

LRA Tables 3.5.2-1 through 3.5.2-6 show AMR line items with no aging effects found in the aging review process. Specifically, the applicant states that no aging effects were found for components fabricated from Pyrocrete® material in environments protected from weather.

During the audit and review, the staff noted that in LRA Table 3.5.2-6 (page 3.5-80), for component fireproofing, the aging effect for Pyrocrete® material in environments protected from weather is none. The staff asked the applicant for a technical basis why Pyrocrete® has no aging effects in the environment listed.

During interviews with the staff, the applicant's personnel stated that Pyrocrete® (for fireproofing) is cement-base composite material not identified in the GALL Report. The applicant's technical evaluation of Pyrocrete® in determining applicable aging effects was the same as that for concrete and based on EPRI 1002950, "Aging Effects for Structures and Structural Components (Structural Tools)," Revision 1, Section 5. Accordingly, the applicant determined no aging effects for Pyrocrete® protected from weather. However, as indicated in LRA Table 3.5.2-6 (page 3.5-80), the Fire Protection Program and Structures Monitoring Program will confirm the absence of significant aging effects throughout the period of extended operation.

The staff found Pyrocrete® a cementitious material that, like concrete, in environments protected from weather experiences no aging effects. Industry operating experience supports the conclusion that there are no aging effects for Pyrocrete® in environments protected from weather. Therefore, no aging effects are applicable to components fabricated from Pyrocrete® material exposed to environments protected from weather. Nonetheless, Pyrocrete® is included within the Fire Protection Program and Structures Monitoring Program to ensure aging effects such as cracking or loss of material do not occur.

On the basis of its review, the staff found that environments protected from weather on Pyrocrete® at PNPS will not cause aging of concern during the period of extended operation. The staff finds acceptable the applicant's AMR evaluations that Pyrocrete® in environments protected from weather has no aging effects. Therefore, the staff concluded that there are no applicable AERMs for Pyrocrete® components exposed to environments protected from weather.

LRA Tables 3.5.2-1 through 3.5.2-6 show AMR line items with no aging effects found in the aging review process. Specifically, the applicant states that no aging effects were found for components fabricated from fiberglass, calcium silicate, or Stratafab® material in environments protected from weather. The LRA states that loss of insulating characteristics due to insulation degradation is not an AERM for insulation material. Insulation products (*i.e.*, made from fiberglass fiber, calcium silicate, SS, and similar materials) protected from weather experience no aging effects that would significantly degrade their ability to insulate as designed. Plant-specific operating experience shows no aging effects for insulation. No aging effects are applicable to components fabricated from fiberglass, calcium silicate, or Stratafab® material exposed to environments protected from weather.

On the basis of its review, the staff found that environments protected from weather on fiberglass, calcium silicate, or Stratafab® will not cause aging of concern during the period of extended operation. Therefore, the staff concluded that there are no applicable AERMs for fiberglass, calcium silicate, or Stratafab® components exposed to environments protected from weather.

LRA Tables 3.5.2-1 through 3.5.2-6 show AMR line items with no aging effects found in the aging review process. Specifically, the applicant states that no aging effects were found for components fabricated from PVC material exposed to environments protected from weather.

During the audit and review, the staff noted that in LRA Table 3.5.2-6 (page 3.5-83) for component water stops the aging effect is none for material PVC in an environment exposed to weather. By definition, the water stop components could be exposed to water. For exposure to fluid environments, the aging effects listed are cracking and change in material properties. The staff asked the applicant for a technical basis why PVC water stops have no aging effects needing aging management when they could be exposed to fluid environments. The staff also asked for the specification that called for PVC instead of rubber water stops during construction.

During interviews, the applicant's technical personnel stated that the PVC water stops shown in LRA Table 3.5.2-6 (page 3.5-83) are in the reinforced concrete basin and not exposed to the same environment as the fill material. The aging effects attributed to PVC water stops are evaluated based on Section 7.0 of the EPRI "Structural Tools." Exposure to water for these commodities is insignificant because the concrete encapsulating the PVC water stop and the surrounding concrete provide protection so ample that aging management is not required.

On the basis that PVC water stops are almost totally encapsulated in concrete to protect them from fluid environments and expose them to only environments protected from weather, the staff found that environments protected from weather on PVC will not cause aging of concern during the period of extended operation. Therefore, the staff concluded that there are no applicable AERMs for PVC components exposed to a weather environment.

On the basis of its audit and review of the applicant's program, the staff found 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).

3.5.2.3.1 Primary Containment Summary of Aging Management Evaluation - LRA Table 3.5.2-1

The staff reviewed LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the primary containment component groups.

In LRA Table 3.5.2-1, the applicant proposed to manage cracking and change in material properties of concrete material for floor slab and wall component types exposed to environments protected from weather using the Structures Monitoring Program.

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. The program visually inspects concrete structures for cracking and change in material properties. On this basis, the staff found management of cracking and change in material properties of concrete material acceptable.

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).

3.5.2.3.2 Reactor Building Summary of Aging Management Evaluation - LRA Table 3.5.2-2

The staff reviewed LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the reactor building component groups.

In LRA Table 3.5.2-2, the applicant proposed to manage loss of stainless materials for spent fuel pool storage rack component types exposed to a fluid environment using the Water Chemistry Control – BWR Program.

During the audit and review, the staff noted in LRA Table 3.5.2-2 (page 3.5-58) that the aging effect is loss of material for component spent fuel pool storage racks, material SS, in an environment exposed to fluid. The staff asked the applicant to explain by what aging mechanism loss of material occurs and why cracking is not the aging effect.

During interviews, the applicant's personnel stated that, as shown in LRA Table 3.5.2-2, the aging effect for component spent fuel pool storage racks is loss of material. The specific aging mechanism is pitting and crevice corrosion because SSs are susceptible to this aging mechanism when exposed to oxygenated water in a treated water environment. Cracking is not an AERM for SS in the spent fuel pool because cracking due to stress corrosion depends on temperature (greater than140 °F). The spent fuel pool treated water environment temperature is less than 140 °F.

The staff's evaluation of the Water Chemistry Control – BWR Program is documented in SER Section 3.0.3.1.11. The objective of the program is to manage aging effects caused by corrosion and cracking mechanisms. The program relies on monitoring and control of water chemistry based on EPRI Report 1008192 (BWRVIP-130). EPRI guidelines in BWRVIP-130 make recommendations for controlling water chemistry in the spent fuel pool. The staff accepts the position that loss of material exhibited by the SS spent fuel pool storage racks exposed to a fluid environment is properly managed by the Water Chemistry Control – BWR Program, which through the addition of chemicals reduces the amount of dissolved oxygen in the spent fuel pool treated water and reduces SS pitting and crevice corrosion. On the basis of its review, the staff found the aging effect of loss of material of SS material exposed to a fluid environment effectively managed by the Water Chemistry Control – BWR Program. On this basis, the staff found management of loss of material of SS spent fuel pool storage racks in the reactor building acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results for material, environment, AERMs, 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 intended 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 Intake Structure Summary of Aging Management Evaluation - LRA Table 3.5.2-3

The staff reviewed LRA Table 3.5.2-3, which summarizes the results of AMR evaluations for the intake structure component groups.

In LRA Table 3.5.2-1, the applicant proposed to manage cracking and change in material properties of concrete material for floor slab and wall component types exposed to environments protected from weather using the Structures Monitoring Program.

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. The program visually inspects concrete structures for cracking and change in material properties. On this basis, the staff found management of cracking and change in material properties of concrete material acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results for material, environment, AERMs, 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 intended 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 Process Facilities Summary of Aging Management Evaluation - LRA Table 3.5.2-4

The staff reviewed LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the process facilities component groups. The results of these evaluations are all consistent with the GALL Report.

3.5.2.3.5 Yard Structures Summary of Aging Management Evaluation - LRA Table 3.5.2-5

The staff reviewed LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the yard structures component groups. The results of these evaluations are all consistent with the GALL Report.

3.5.2.3.6 Bulk Commodities Summary of Aging Management Evaluation - LRA Table 3.5.2-6

The staff reviewed LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the bulk commodities component groups.

In LRA Table 3.5.2-6, the applicant proposed to manage cracking and delaminating separation of cera blanket materials for fire stop component types exposed to environments protected from weather using the Fire Protection Program.

The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3.2.11. The Fire Protection Program inspects fire barriers and diesel-driven fire pumps. The fire barrier inspection requires periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of fire-rated doors to maintain their operability. The diesel-driven fire pump inspection requires periodic testing for whether the fuel supply line can perform its intended function. The staff determined that cracking and delaminating separation exhibited by cera blanket materials for fire stops exposed to environments protected from weather is properly managed by the Fire Protection Program, which under program element "detection of aging effects" will examine cera blanket fire stops to detect cracking and delaminating separation. On the basis of its review, the staff found the aging effects of cracking and delaminating separation of cera blanket material exposed to environments protected from weather effectively managed by the Fire Protection Program. On this basis, the staff found management of cracking and delaminating separation of cera blanket fire stops in bulk commodities acceptable.

In LRA Table 3.5.2-6, the applicant proposed to manage loss of material of cerafiber and cera blanket materials for fire wrap component types exposed to environments protected from weather using the Fire Protection Program.

The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3.2.11. The Fire Protection Program inspects fire barriers and diesel-driven fire pumps. The fire barrier inspection requires periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of fire-rated doors to maintain their operability. The diesel-driven fire pump inspection requires periodic testing for whether the fuel supply line can perform its intended function. The staff determined that loss of material exhibited by cerafiber and cera blanket materials for fire wraps exposed to environments protected from weather is properly managed by the Fire Protection Program, which under program element "detection of aging effects" will examine cerafiber and cera blanket fire wraps to detect loss of material. On the basis of its review, the staff found the aging effect of loss of material of cerafiber and cera blanket material exposed to environments protected from weather effectively managed by the Fire Protection Program. On this basis, the staff found management of loss of material of cerafiber and cera blanket fire wraps in bulk commodities acceptable.

In LRA Table 3.5.2-6, the applicant proposed to manage cracking and change in material properties for building pressure boundary sealant and compressible joint and seal of elastomer material components types exposed to environments protected from weather using the Structures Monitoring Program.

The staff's evaluation of the Structures Monitoring Program is documented in SER Section 3.0.3.2.17. The Structures Monitoring Program will be enhanced with guidance for performing structural examination of elastomer materials to detect cracking and change in material properties. On this basis, the staff found management of loss of material of elastomers acceptable.

On the basis of its review, the staff finds that the applicant appropriately evaluated the AMR results for material, environment, AERMs, 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).

3.5.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the structures and component supports components 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

This section of the SER documents the staff's review of the applicant's AMR results for the electrical and I&C system components and component groups of the following:

- high-voltage insulators
- insulated cables and connections
- phase bus
- switchyard bus

3.6.1 Summary of Technical Information in the Application

In LRA Table 3.6.1, "Summary of Aging Management Programs for the Electrical and I&C Components Evaluated in Chapter VI of the NUREG-1801" is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the electrical and I&C system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.6.2 Staff Evaluation

The staff reviewed LRA Section 3.6 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the electrical and I&C system components are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of AMRs to confirm the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL 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 Audit and Review Report Section 3.6.2.1 and are summarized in SER Section 3.6.2.1.

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 SRP-LR Section 3.6.2.2 acceptance criteria. The staff's audit evaluations are documented in Audit and Review Report Section 3.6.2.2 and summarized in SER Section 3.6.2.2.

In the onsite audit, the staff also conducted a technical review of the remaining AMRs not consistent with, or not addressed in, the GALL Report. The audit and 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 audit evaluations are documented in Audit and Review Report Section 3.6.2.3 and summarized in SER Section 3.6.2.3. The staff's evaluation of the technical review is also documented in SER Section 3.6.2.3.

The staff reviewed the UFSAR supplement AMP summary descriptions to determine if they adequately described the programs credited with managing or monitoring aging for the electrical and I&C system components.

Table 3.6-1 summarizes the staff's evaluation of components, aging effects/mechanisms AEMs, 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	AMP in LRA	Staff Evaluation
Electrical equipment subject to 10 CFR 50.49 EQ requirements (3.6.1-1)	Degradation due to various aging mechanisms	Environmental Qualification of Electric Components	Environmental Qualification of Electric Components	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.6.2.2.1)
Electrical cables, connections and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements (3.6.1-2)	Reduced insulation resistance (IR) 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	Non-EQ Insulated Cables and Connections	Consistent with GALL Report, which recommends no further evaluation (See SER 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 IR (3.6.1-3)	Reduced IR 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	Non-EQ Instrumentation Circuits Test Review	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.6.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	Non-EQ Inaccessible Medium-Voltage Cable Program	Consistent with GALL Report, which recommends no further evaluation (See SER 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	None	Not applicable to BWRs
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	None	Not consistent with GALL Report (See SER Section 3.6.2.3)
Metal-Enclosed Bus (MEB) - Bus/connections (3.6.1-7)	Loosening of bolted connections due to thermal cycling and ohmic heating	Metal-Enclosed Bus	Metal-Enclosed Bus Inspection	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.6.2.1)
MEB - Insulation/insulators (3.6.1-8)	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure due to thermal/ thermoxidative degradation of organics / thermoplastics, radiation induced oxidation; moisture/debris intrusion, and ohmic heating	Metal-Enclosed Bus	Metal-Enclosed Bus Inspection	Consistent with GALL Report, which recommends no further evaluation (See SER Section 3.6.2.1)

Component Group (GALL Report Item No.)	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
MEB - Enclosure assemblies (3.6.1-9)	Loss of material due to general corrosion	Structures Monitoring Program	Metal-Enclosed Bus Inspection	Consistent with GALL Report on material, environment, and aging effects but different program is credited (See SER Section 3.6.2.1)
MEB - Enclosure assemblies (3.6.1-10)	Hardening and loss of strength due to elastomers degradation	Structures Monitoring Program	Metal-Enclosed Bus Inspection	Consistent with GALL Report on material, environment, and aging effects but different program is credited (See SER Section 3.6.2.1)
High-voltage insulators (3.6.1-11)	Degradation of insulation quality due to presence of any salt deposits and surface contamination; Loss of material caused by mechanical wear due to wind blowing on transmission conductors	A plant-specific AMP is to be evaluated	None	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.6.2.2)
Transmission conductors and connections; switchyard bus and connections (3.6.1-12)	Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; increased resistance of connection due to oxidation or loss of preload	A plant-specific AMP is to be evaluated	None	Consistent with GALL Report, which recommends further evaluation (See SER Section 3.6.2.2)
Cable Connections - Metallic parts (3.6.1-13)	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Electrical Cable Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	None	Not consistent with GALL Report (See SER Section 3.6.2.3)
Fuse Holders (Not Part of a Larger Assembly) Insulation material (3.6.1-14)	None	None	None	Consistent with GALL Report

The staff's review of the electrical and I&C system component groups followed 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 system components is documented in SER Section 3.0.3.

3.6.2.1 AMR Results Consistent with the GALL Report

Summary of Technical Information in the Application. LRA Section 3.6.2.1 identifies the materials, environments, AERMs, and the following programs that manage the effects of aging related to the electrical and I&C system components:

- Metal-Enclosed Bus Inspection Program
- Non-EQ Inaccessible Medium-Voltage Cable Program
- Non-EQ Instrumentation Circuits Test Review Program
- Non-EQ Insulated Cables and Connections Program

LRA Table 3.6.2-1 summarizes AMRs for the electrical and I&C system components and indicates AMRs it considered to be consistent with the GALL Report.

Staff Evaluation. For component groups evaluated in the GALL Report for which the applicant claimed consistency with the GALL Report and for which the GALL Report does not recommend further evaluation, the staff 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 AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

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

Note C indicates that the component for the AMR line item is different but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the AMP identified in the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified a different component in the GALL Report 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 is different but consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the AMP identified in the GALL Report. The staff audited these line items to verify consistency with the GALL Report. The staff 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 AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but 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 AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff audited and reviewed the information provided in the LRA as documented in Audit and Review Report Section 3.6.2.1. 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 AMRs. The staff's evaluation follows:

3.6.2.1.1 Loss of Material Due to General Corrosion

The discussion column of LRA Table 3.6.1, item 3.6.1-9, states that loss of material of MEB – enclosure assemblies is managed by the Metal-Enclosed Bus Inspection Program. During the audit and review, the staff noted that the AMR result line pointing to LRA Table 3.6.1, item 3.6.1-9 referred to Note E.

The staff reviewed the AMR results line referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report. However, where the GALL Report recommends GALL AMP XI.S6, "Structures Monitoring Program," the applicant has instead proposed the Metal-Enclosed Bus Inspection Program.

GALL Report, Section VI, items VI.A-12 and VI-13, refer to the Structures Monitoring Program for inspection of the MEB external for loss of material due to general corrosion, and the enclosure seals for hardening and loss of strength due to elastomer degradation. LRA Section B.1.18 states that the program attribute of the Metal-Enclosed Bus Inspection Program would be consistent with that in GALL Report, Section XI.E4, with an exception to inspect MEB enclosure assemblies in addition to internal surfaces by the Metal-Enclosed Bus Inspection Program.

The staff asked the applicant if the enclosure seals were included within the scope of the

Metal-Enclosed Bus Inspection Program. The staff also asked for the acceptance criteria for inspection of the enclosure assembly externals.

In response, the applicant stated that the Metal-Enclosed Bus Inspection Program will inspect the enclosure assemblies visually for evidence of loss of material. The program also will visually inspect and manually flex enclosure assembly elastomers. The applicant revised the program evaluation report as follows:

> The acceptance criteria for enclosure assemblies will be no loss of material due to general corrosion. The acceptance criteria for elastomers will be no hardening and loss of strength due to degradation.

The staff found the applicant's response acceptable as consistent with the GALL Report Structural Monitoring Program. The applicant will inspect MEB externally, including seals (elastomers), and provide in the plant's basis document acceptance criteria for inspection of MEB external components. On these bases, the staff found this exception acceptable.

3.6.2.1.2 Hardening and Loss of Strength Due to Elastomer Degradation

The discussion column of LRA Table 3.6.1, item 3.6.1-10, states that elastomer degradation of MEB – enclosure assemblies is managed by the Metal-Enclosed Bus Inspection Program. During the audit and review, the staff noted that the AMR results line pointing to Table 3.6.1, item 3.6.1-10 referred to Note E.

The staff reviewed the AMR results line referring to Note E and determined that the component type, material, environment, and aging effect are consistent with those of the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.S6, "Structures Monitoring Program," the applicant has proposed the Metal-Enclosed Bus Inspection Program.

As stated in Section 3.6.2.1.1, the staff found the Metal-Enclosed Bus Inspection Program acceptable to inspect the elastomer degradation.

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 the associated aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with its AMRs in the GALL Report. 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 for 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

Summary of Technical Information in the Application. In LRA Section 3.6.2.2 the applicant further evaluates aging management, as recommended by the GALL Report, for the electrical and I&C system components and provides information concerning how it will manage the following aging effects:

- electrical equipment subject to EQ
- degradation of insulator quality due to salt deposits and surface contamination, and loss of material due to mechanical wear
- loss of material due to wind induced-abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load
- QA for aging management of nonsafety-related components

Staff Evaluation. For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the GALL Report and for which the GALL Report recommends further evaluation, the staff audited and reviewed the applicant's 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. Details of the staff's audit are documented in Audit and Review Report 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 Environmental Qualification (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 evaluation of the applicant's evaluation of this TLAA.

3.6.2.2.2 Degradation of Insulator Quality Due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material Due to Mechanical Wear

The staff reviewed LRA Section 3.6.2.2.2 against the criteria in SRP-LR Section 3.6.2.2.2.

LRA Section 3.6.2.2.2 states that high-voltage insulators supporting conductors that recover offsite power following SBO include those of the switchyard bus located between switchyard breakers 352-2/352-3 and startup transformer X4. High-voltage insulators for this path are subject to AMR. Various airborne materials (*e.g.*, dust, salt, industrial effluents) can contaminate insulator surfaces. The buildup of surface contamination in most areas is washed away by rain. The glazed and coated insulator surface aids this contamination removal. A large buildup of contamination facilitates conductor voltage tracking along the surface and can lead to insulator flashover. PNPS is located near the seacoast, so salt spray is considered; however, salt spray buildup is a short-term concern based on local weather conditions (event-driven). Under conducive weather conditions, salt buildup occurs in a matter of hours or days. Therefore, surface contamination is not an applicable aging mechanism for high-voltage insulators. Mechanical wear is an aging effect for strain and suspension insulators subject to movement. Wear has not been apparent during routine inspections. If left unmanaged for the period of extended operation, surface rust would not cause a loss of intended function and, thus, is not a significant concern. Loss of material due to wear will not cause a loss of the insulator intended function. The LRA concludes that loss of material is not an AERM for insulators.

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 blowing on transmission conductors may occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

The staff noted that industry operating experience shows potential for loss of offsite power due to salt deposits on switchyard insulators. On March 17, 1993, Crystal River Unit 3 experienced a loss of the 230 kV switchyard (normal offsite power to safety-related buses) when a light rain caused arcing across salt-laden 230 kV insulators and opened switchyard breakers. In March 1993, the Brunswick Unit 2 switchyard experienced a flashover of some high-voltage insulators attributed to a winter storm. Since 1982, PNPS also experienced several losses of offsite power when ocean storms deposited salt on the 345 kV switchyard, causing the insulator to arc to ground. In light of this industry and plant-specific operating experience, the staff asked the applicant to justify why an AMP is not necessary.

In response, the applicant stated that, as shown by operating experience cited in this question, flashover due to salt contamination of insulators is caused by events, typically storms, regardless of insulator age and clearly not the effects of aging. Therefore, surface contamination is not an applicable aging mechanism for high-voltage insulators. The applicant stated that because the condition is caused by severe weather conditions unrelated to aging, an AMP is not appropriate to address this concern. Although salt spray buildup is a short-term concern based on local weather conditions (event-driven), such buildup can cause problems with the offsite power supply system. Because of this operating experience, PNPS has applied Sylgard® (room-temperature vulcanizing (RTV) silicone) coating to some switchyard insulators to reduce flashover. According to the applicant the addition of RTV silicone to the insulators has reduced the likelihood of insulator flashover. In addition, system walkdowns each refueling cycle and normally more frequently, visually inspect switchyard high-voltage insulators within the scope of license renewal in accordance with the applicant's system walkdown enhancement (EN-DC-178). These walkdowns will continue into the period of extended operation. The staff found the applicant's response acceptable because visual inspections of insulators are performed by the system walkdowns. These walkdowns will detect any aging degradation due to the presence of salt deposits.

LRA Section 3.6.2.2.2 states that mechanical wear, an aging effect for strain and suspension insulators subject to movement, has not been apparent during routine inspections. If left unmanaged for the period of extended operation, surface rust would not cause a loss of intended function and, thus, is not a significant concern. Loss of material due to mechanical wear from wind on transmission conductors occurs in high-voltage insulators.

The staff asked the applicant to justify technically why loss of material is not a significant AERM and why surface rust would not cause a loss of high-voltage insulator intended function if unmanaged for the period of extended operation.

In response, the applicant states that loss of material due to mechanical wear is an aging effect for strain and suspension insulators subject to significant movement. A possible cause for movement of the insulators is wind on the supported transmission conductor, making it swing from side to side. Although this mechanism is possible, industry operating experience shows that transmission conductors normally do not swing in substantial wind or do not continue to swing when the wind subsides. The applicant stated that PNPS has no transmission conductors supported by high-voltage insulators within the scope of license renewal, and, therefore, loss of material due to wear of high-voltage insulators is not an AERM for the period of extended operation. According the that applicant various airborne materials (*e.g.*, dust, salt, and industrial effluents) can contaminate insulator surfaces. The buildup of surface contamination is gradual and in most areas washed away by rain while the glazed and coated insulator surfaces at PNPS aids in contamination removal. The applicant applied Sylgard® (RTV silicone) coatings to some switchyard insulators to reduce flashover. Surface contamination can be a problem in areas where there are greater concentrations of airborne particles, such as, facilities that discharge soot. The applicant stated that PNPS is not located near any such facility; therefore, surface contamination is not an applicable aging mechanism for high-voltage insulators.

The staff found the applicant's response acceptable because PNPS has no transmission conductors supported by high-voltage insulators within the scope of license renewal. Therefore, aging due to mechanical wear of high-voltage insulators is not an applicable aging effect. The SRP-LR states that surface contamination of high-voltage insulators can be a problem in areas of great concentrations of airborne particles near, for example, facilities that discharge soot. As PNPS is not located near any such facilities, surface contamination is not an applicable aging mechanism for high-voltage insulators.

As to the surface rust aging effect, the applicant responded that LRA Section 3.6.2.2.2 has a typographical error in the fourth paragraph. In its response dated July 19, 2006, the applicant revised LRA Section 3.6.2.2.2:

> Mechanical wear is an aging effect for strain and suspension insulator in that they are subject to movement. Wear has not been apparent during routine inspections. If left unmanaged for period of extended operation, surface contamination would not cause a loss of intended function and thus, is not a significant concern.

The staff found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.6.2.2.2 for further evaluation. For those line items that apply to LRA Section 3.6.2.2.2, 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).

3.6.2.2.3 Loss of Material Due to Wind Induced Abrasion and Fatigue, Loss of Conductor Strength Due to Corrosion, an 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.

LRA Section 3.6.2.2.3 states that transmission conductors are uninsulated, stranded electrical cables outside buildings in high-voltage applications. The transmission conductor commodity group includes fastening hardware but excludes high-voltage insulators. Major active equipment assemblies include their transmission conductor terminations.

The LRA also states that transmission conductors are subject to an AMR if they are necessary for recovery of offsite power following an SBO. However, PNPS does not utilize transmission conductors in the circuits for recovery of offsite power following SBO. Other transmission conductors are not subject to AMR because they perform no license renewal intended function. The switchyard bus uninsulated, unenclosed, rigid electrical conductors are for medium- and high-voltage applications. The switchyard bus includes the hardware securing the bus to high-voltage insulators and establishes electrical connections to disconnect switches, switchyard breakers, and transformers for recovery of offsite power following SBO. The LRA states that connection surface oxidation of the aluminum switchyard bus is not applicable because switchyard bus connections requiring AMR are welded connections. For ambient environmental conditions at PNPS, no aging effects could cause a loss of intended function for the period of extended operation. Vibration is not applicable as flexible connectors connect the switchyard bus. Therefore, there are no AERMs for aluminum switchyard buses.

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 this aging effect is adequately managed.

The staff noted that torque relaxation for bolted connection is a concern for switchyard bus connections. An electrical connection must be designed to remain tight and maintain good conductivity through a wide temperature range. This design requirement is difficult if the materials specified for the bolt and the conductor are different, and have different thermal expansion coefficients. For example, copper or aluminum bus/conductor materials expand more quickly than most bolting materials. If thermal stress is added to stresses inherent at assembly, the join member or fasteners can yield. If plastic deformation occurs during thermal loading (*i.e.*, heatup) then when the connection cools, the joint will be loose. EPRI document TR-104213, "Bolted Joint Maintenance and Application Guide," recommends inspection of bolted joints for evidence of overheating, burning or discoloration, and loose bolts.

The staff requested a technical discussion during the Audit & Review to discuss why torque relaxation for bolted connection of the switchyard bus is not a concern.

In its response, the applicant stated that bus to bus connections are welded instead of bolted. Switchyard buses are connected flexibly to insulator and active components. As the switchyard bus typically is under a constant load, thermal cycling that could cause torque relaxation is infrequent. With no switchyard bus connection to vibrating equipment, vibration is not an aging mechanism. The switchyard connection to the startup transformer is part of the active assembly maintained by the plant maintenance program; therefore, torque relaxation is not an AERM for the switchyard bus. In addition, thermography at least every six months maintains the integrity of the connections. This program will continue into the period of extended operation.

The staff found the applicant's response acceptable because thermography detects the heat created by high resistance due to bolt loosening of switchyard bus connections. The staff reviewed PNPS Procedure No. 3.M.3-60, "Infrared Thermography," and verified that switchyard bus connections to startup transformers and air circuit breakers within the scope of license renewal are inspected for bolt loosening.

Increased resistance of switchyard bus connections due to oxidation is a potential aging effect. The staff requested a technical justification of why increased resistance of connection due to oxidation is not an AERM.

In its response, the applicant stated that a mechanism potentially contributing to switchyard bus connection aging is surface oxidation, which can lead to increased contact or connection resistance. Connection surface oxidation is not significant for PNPS switchyard bus connections as they are welded. Therefore, no aging effects due to surface oxidation require management for the period of extended operation. The connections to active devices are inspected under the Maintenance Rule program. In addition, thermography at least every six months maintains connection integrity. This program will continue into the period of extended operation.

The staff found the applicant's response acceptable because heat created by increased resistance of switchyard bus connections due to corrosion will be detected by thermography to maintain the integrity of the connections.

The staff found that, based on the programs identified above, the applicant has met the criterion of SRP-LR Section 3.6.2.2.3 for further evaluation.

Based on the programs identified above, the staff concludes that the applicant has met the criterion 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 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).

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

The staff's evaluation of the applicant's QA program for safety-related and nonsafety-related components is in SER Section 3.0.4.

3.6.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

Summary of Technical Information in the Application. The staff reviewed additional details of the AMR results LRA Table 3.6.2-1 for material, environment, AERM, and AMP combinations not consistent with the GALL Report or not addressed in the GALL Report.

In LRA Table 3.6.2-1, the applicant indicated, via notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. 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.

Staff Evaluation. For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.6.2.3.1 Electrical Components Summary of Aging Management Evaluation

The LRA Table 3.6.1, item 3.6.1-6 discussion column states 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) with metallic clamps is not applicable because PNPS documents indicate that fuse holders with metallic clamps are either parts of active devices or located in circuits with no license renewal intended function. Therefore, fuse holders with metallic clamps are not subject to an AMR.

On the basis that fuse holders are either parts of active assemblies or located in circuits with no license renewal intended function, the staff found that an AMR is not required for fuse holders (insulation and metallic parts). The staff found that no aging effect applies to this component type.

The LRA Table 3.6.1, item 3.6.1-13 discussion column states that the loosening of bolting connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation of the metallic parts of cable connections is not applicable because cable connectors outside of active devices are taped or sleeved for protection. Operating experience with metallic pins on electrical cable connections indicates no AERMs.

The staff noted that electrical cable connections are subject to such aging stressors. GALL AMP XI.E6, "Electrical Cable Connection Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," specifies that connections for cables within the scope of license renewal are parts of this program regardless of their association with active or passive components. The staff requested that the applicant provide a basis document with an AMP with the 10 elements for cable connections or a technical justification for why an AMP was not necessary.

In its response, the applicant stated that an evaluation of thermal cycling, ohmic heating, electrical transient, vibration, chemical contamination, corrosion, and oxidation stressors for the metallic parts of electrical cable connections detected no AERMs. Metallic parts of electrical cable connections potentially exposed to thermal cycling and ohmic heating carry significant current in power supply circuits. Typically, power cables are in a continuous run from the supply to the load. Therefore, the connections are parts of active components controlled by the Maintenance Rule and not subject to an AMR. The applicant stated that fast action of circuit protective devices at high currents mitigates stresses from electrical faults and transients. In addition, mechanical stress from electrical faults is not a plausible aging mechanism because of the low frequency of such faults; therefore, electrical transients are not applicable stressors. Metallic parts of electrical cable connections exposed to vibration are for active components that cause vibration. The applicant stated that active components are controlled by the Maintenance Rule and not subject to an AMR. Corrosive chemicals are not stored in most areas of the plant. Routine releases of corrosive chemicals inside the plant building do not occur during plant operation. Such releases, and their effects, would be events, not effects of aging. The location of electrical connections inside active components protects metallic parts from contamination. Therefore, this stressor is not applicable. The applicant stated further that oxidation and corrosion usually occur in the presence of moisture or contamination (*e.g.*, industrial pollutants, salt deposits). Enclosures or spice materials protect metal connections from moisture or contamination; therefore, oxidation and corrosion are not applicable stressors. Based on the above evaluation, the applicant concluded that there are no AERMs for metallic components of connections and no AMP is required.

The staff disagreed with the applicant's conclusion. Connections are passive components and within the scope of license renewal. Loosening of bolted connections is the aging effect needing management. Thermal cycling, ohmic heating, electrical transients, vibrations, chemical contamination, corrosion, and oxidation are aging mechanisms. Connections for cables within the scope of license renewal are parts of this program regardless of their association with active or passive components. Cable lugs are parts of cables and lug integrity can be verified by testing connections. GALL AMP XI.E1 manages connections in adverse locations only and inspects insulation for degradation. Most connections at PNPS are not located in adverse locations.

Sandia National Laboratories (SAND) 96-0344, "Aging Management Guidelines for Electrical Cable and Terminations," indicates loose terminations were detected at several plants. EPRI-TR-104213, "Bolted Joint Maintenance and Application Guide," indicates that it is difficult to maintain tightness of electrical connections, and good conductivity, through a large temperature range if the materials for the bolt connections and conductors are different with different thermal expansion rates. For example, copper and aluminum expand more quickly than most bolting materials. The staff was not aware of any action to manage the aging effects of cable connections though there were several licensee event reports of loose connections due to corrosion, vibration, thermal cycling, etc. Other applicants have used an approved thermography method to detect weak/loose connections and to correct them as soon as possible. GALL AMP XI.E6 is for management of aging effects of bolted connections.

In RAI 3.6.2-1 dated August 14, 2006, the staff requested the applicant clarify how it proposes to manage the aging effects of cable connection components.

In a letter dated September 13, 2006, the applicant stated that:

> While AMP XI.E6 does not clearly identify aging effects of concern, it does list the following stressors. Each listed stressor is evaluated as follows.
>
> Thermal cycling -Thermal cycling is a concern based on the number of thermal cycles independent of component age. Causes of thermal cycling include ohmic heating caused by large changes in power circuit loads. Proper sizing of conductors minimizes thermal cycling due to cyclic loads that could cause connection degradation. In addition, most power circuits in the scope of license renewal are either continuously loaded or continuously in standby, and therefore infrequently subjected to load cycles.

Ohmic heating -Another cause of thermal cycling, ohmic heating, is a concern due to the number of thermal cycles independent of component age. Proper design prevents ohmic heating that could cause connection degradation due to thermal cycling.

Electrical transients -Another cause of thermal cycling, electrical transients, are a concern based on the number of transients independent of component age. Electrical transients are events independent of aging. Circuit designs include protective features to minimize the effects of electrical transients, which occur infrequently.

Vibration -Vibration is a concern based on the number of cycles independent of component age. Vibration results from operation of active devices and excessive vibration can cause connection degradation in a relatively short time regardless of component age.

Chemical contamination -Chemical contamination is an event. Chemical contamination can cause loss of circuit continuity due to excessive corrosion in a short time independent of component age. Connections are protected by design with enclosures and therefore not subjected to chemical contamination.

Corrosion and oxidation -Corrosion and oxidation are age-dependent given materials and environment that are conducive to corrosion and oxidation. Proper circuit design provides assurance that corrosion and oxidation are not mechanisms that cause loss of circuit continuity. Connections are protected by design with enclosures that prevent exposure to environments that cause corrosion and oxidation.

While none of the stressors listed in AMP XI.E6 are aging mechanisms, they can have detrimental effects on electrical connections. Those effects, although not aging effects, are prevented by proper circuit design and maintenance practices. The effectiveness of those practices is verified by maintenance rule program activities. Electrical cable connections at PNPS are inspected under the maintenance rule program as directed by Entergy procedures. The maintenance rule program, based on industry guidance provided in NUMARC93-01 and Regulatory Guide 1.160, is intended to assure compliance with 10 CFR 50.65.

Electrical cable connections are subcomponents of SSCs that are in the scope of the maintenance rule.

The maintenance rule program includes performance monitoring and trending for SSCs. Monitoring and trending are:

- Performed frequently enough to detect and correct degrading equipment performance
- Used to evaluate equipment performance following maintenance or modification

- Based on manufacturer's recommendations and operating experience * Subject to the corrective action program

Thermography can detect "hot spots" in cable connections that are indicative of high resistance connections. Thermography is used, where practical, to detect potential degraded conditions. Thermography is not always practical because access may not be available to connections while the associated loads are in service. Those connections are typically associated with active devices such as switchgear and motors.

As a part of the maintenance rule program, periodic assessments are performed to evaluate the effectiveness of maintenance activities. These assessments are performed at least once every operating cycle.

Plant operating experience has shown that the maintenance rule program has been effective at managing electrical cable connection degradation.

In summary, stressors identified in the XI.E6 AMP are not aging mechanisms. However, the maintenance rule program does manage the effects of those stressors providing reasonable assurance that electrical cable connections will remain capable of performing their intended functions through the period of extended operation. PNPS operating experience confirms the effectiveness of the maintenance rule program. Monitoring and trending within the maintenance rule program, in conjunction with the corrective action program, will ensure that the maintenance rule program will continue to be effective through the period of extended operation. No aging management program (AMP) for license renewal is required at PNPS since the regulatory mandated maintenance rule program effectively maintains electrical cable connections.

It should be noted that the CLBs for all power plants require compliance with the Maintenance Rule, 10 CFR 50.65. The Statements of Consideration for the license renewal rule state: "The license renewal rule excludes 'active, short-lived structures and components' from an aging management review because of the existing regulatory process, existing licensee programs and activities, and the maintenance rule." The staff's understanding is that, under the license renewal rule, existing programs are not, without some explanation or modification, automatically deemed adequate to manage aging effects for license renewal as parts of the CLB. The NRC formulated the following two principles of license renewal: (1) With the possible exceptions of the detrimental effects of aging on the functionality of certain plant SSCs and possibly a few other safety issues during extended operation, the regulatory process is adequate to ensure that the licensing bases of all operating plants maintain an acceptable level of safety so operation will not be inimical to public health and safety or common defense and security and (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.

Under 10 CFR 54.21 (a)(ii)(3) applicants must demonstrate that the effects of aging of components like cable connections defined in 10 CFR 54.21 (a)(3) will be adequately managed so intended function(s) will be maintained consistent with the CLB for the period of extended operation. To demonstrate that the effects of aging will be adequately managed for license renewal, applicants must describe the program relied upon to manage certain aging effects for cable connections. The acceptable AMP for cable connections is GALL AMP XI.E6, which states that the AMP for electrical cable connections (metallic parts) accounts for the following stressors: thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation.

In a follow up to RAI 3.6.2-1 dated November 2, 2006, the staff requested either a plant-specific AMP with the elements of SRP-LR, Appendix A.1, Section A.1.2.3 and SRP-LR Table A.1-1 or an AMP consistent with GALL AMP XI.E6. The staff stated:

> If the applicant insists no AMP is required, the staff requests a detailed explanation of how the existing program will address the aging effects and a detailed discussion of how the current program meets each of the 10 program elements described in the SRP. The staff also requests supporting documentation to show that the AMP elements including appropriate tests are implemented and will be continued for the period of extended operation. Without such information, the staff may not be able to conclude that actions have been or will be taken to manage the effects of aging during the period of extended operation to ensure functionality of those structures and components.

In a letter dated January 10, 2007, the applicant stated:

> LRA Amendment 8, in response to RAI 3.6.2-1, stated that an XI.E6 program was not required. Based on the November 30, 2006, meeting with the NRC, an alternate plant-specific program, which will be a one-time inspection of a representative sample of cable connections subject to AMR, will be used at PNPS.
>
> Basis for Clarification
>
> Based on the November 30, 2006, meeting with the NRC, the Pilgrim Bolted Cable Connections Program will be a one-time inspection of a representative sample of cable connections subject to AMR.
>
> Switchyard connections are not addressed in this program. Since these connections operate at a much higher voltage (>35 kV), they are addressed separately as part of the switchyard commodity types. Cable connections for medium and low voltage levels are included in this program. As discussed during the November 30, 2006 NEI-NRC meeting, bolted connections are the main concern. High load bolted connections are included in this program.
>
> For low load connections, thermal cycling, ohmic heating, and electrical transients are not potential stressors. In addition, vibration, chemical contamination, corrosion and oxidation are not a concern for low load connections located in a controlled environment. Low load in-scope field instrumentation connections, such as those for pressure transmitter, resistance temperature detectors (RTDs), and flow transmitters, are not subject to AMR because the in-scope instrumentation located in a harsh environment is typically EQ. The non-EQ sensitive instrument circuit (high radiation and neutron monitoring) connections are included in the XI.E2 program. Connections associated with circuits that do not have an intended function, such as general lighting, are not subject to AMR.

In the letter dated January 10, 2007, the applicant added LRA Sections A.2.1.40 and B.1.34 describing its Bolted Cable Connections Program and amended LRA Section 3.6.2.1, Aging Effects Requiring Management, Section 3.6.2.1, Aging Management Program, Table 3.6.1, and Table 3.6.2-1. The applicant also included the plant-specific program elements for the Bolted Cable Connections Program. The staff's evaluation of the Bolted Cable Connections Program is documented in SER Section 3.0.3.3.7.

In response to NEI's White Paper on GALL AMP XI.E6 submitted on September 5, 2006, for staff's review, the staff found that only a few operating experiences related to failed connections due to aging have been identified and these operating experiences can not support a periodic inspection as currently recommended in GALL AMP XI.E6. The staff will consider revising XI.E6 to recommend a one-time inspection on a representative basis. The staff also found that switchyard connections, connections located in harsh environment and connections associated with high-voltage low level signal circuits (GALL XI.E2) need not to be included in this one-time inspection. Switchyard connections are addressed in SER Section 3.6.2.2. Connections located in harsh environments are covered under 10 CFR 50.49 EQ rule. Non-EQ connections associated with sensitive high-voltage low level signal circuits are covered under GALL XI.E2.

On this basis, the staff found the applicant's response to RAI 3.6.2-1 acceptable because the design of these connections will account for the stresses associated with ohmic heating, thermal cycling, and dissimilar connections. The one-time inspection will ensure that either aging of metallic cable connections is not occurring or existing maintenance program is effective such that a periodic inspection is not required. Therefore, the staff's concern described in RAI 3.6.2-1 is resolved.

On the basis of its audit and review of the applicant's program, the staff found 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).

3.6.3 Conclusion

The staff concludes that the aging effects of electrical components will be adequately managed to maintain intended functions 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 program summaries and concludes that they adequately describe the AMPs credited for managing aging of electrical components, as required by 10 CFR 54.21(d).

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." On the basis of its review of the AMR results and AMPs, the staff concludes that the applicant has demonstrated that the aging effects will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable UFSAR supplement program summaries and concludes that the supplement adequately describes the AMPs credited for managing aging, as required by 10 CFR 54.21(d).

With regard to these matters, the staff concludes that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and any changes made to the CLB, in order to comply with 10 CFR 54.21(a)(3), are in accordance with the 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, Entergy Nuclear Operations, Inc. (ENO or the applicant) addressed the TLAAs for Pilgrim Nuclear Power Station (PNPS). SER Sections 4.2 through 4.8 document the review of the TLAAs, as 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 in accordance with 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.

4.1.1 Summary of Technical Information in the Application

To identify the TLAAs, the applicant evaluated calculations and analyses for PNPS against the six criteria specified in 10 CFR 54.3. The applicant indicated that it has identified the calculations that met the six criteria by searching the current licensing basis (CLB). The CLB includes the updated final safety analysis report (UFSAR), engineering calculations, technical reports, engineering work requests, licensing correspondence, and applicable vendor reports. In LRA Table 4.1-1, "List of PNPS TLAA and Resolution," the applicant listed the applicable TLAAs as follows:

- reactor vessel neutron embrittlement
- metal fatigue
- environmental qualification (EQ) of electrical components
- concrete containment tendon prestress
- containment liner plate, metal containment, and penetrations fatigue
- reflood thermal shock analyses of the reactor vessel internals
- Boiling-Water Reactor Vessel and Internals Project (BWRVIP)-05, reactor pressure vessel (RPV) circumferential welds analysis
- BWRVIP-48, vessel inner diameter (ID) attachment welds fatigue analysis
- BWRVIP-49, instrument penetrations fatigue analysis

- BWRVIP-74, reactor vessel
- BWRVIP-76, core shroud fatigue analysis

Pursuant to 10 CFR 54.21(c)(2), the applicant stated that it did not identify any exemptions granted in accordance with 10 CFR 50.12 based on a TLAA as defined in 10 CFR 54.3.

4.1.2 Staff Evaluation

LRA Section 4.1 lists the PNPS TLAAs. The staff reviewed the information to determine whether the applicant has provided sufficient information pursuant to 10 CFR 54.21(c)(1) and (2).

As defined in 10 CFR 54.3, TLAAs meet the six criteria as follows:

(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 PNPS in LRA Table 4.1-1.

During two audits of the LRA TLAAs, the first June 19 - 23, 2006, and a followup July 17 - 19, 2006, the staff determined that the applicant had conservatively identified all plant-specific evaluations, analyses, assessments, and calculations that complied with the 10 CFR 54.3 TLAA definition with exceptions detailed in SER Section 4.1.2.1.

4.1.2.1 Flaw Growth Evaluations

The staff determined that the applicant had identified for the LRA three flaw growth evaluations as potential TLAAs for the LRA: the (N2F) recirculation nozzle, the recirculation nozzle thermal sleeves, and the control rod drive return line (CRDRL) nozzle-to-cap weld. The applicant stated, after further consideration and review, that these flaw evaluations were not TLAAs for the LRA. The staff asked the applicant to justify its position that the flaw evaluations were not TLAAs for the LRA. On September 13, 2006, the applicant responded to the staff's question on bases for the conclusion that the flaw evaluations for the CRDRL nozzle-to-cap weld, the N2F recirculation nozzle, and the recirculation nozzle thermal sleeve were not TLAAs for the LRA.

The applicant's response to the staff's question on these flaw evaluations was reviewed for acceptability to determine whether these flaw evaluations are TLAAs for the LRA.

License Renewal Procedure Document (LRPD)-06, Section 2.4, provides the applicant's bases for concluding whether the flaw evaluations for the N2F recirculation nozzle, recirculation nozzle sleeve, and CRDL nozzle-to-cap weld are TLAAs for the LRA.

Applicants are required to evaluate flaws detected during inservice inspections (ISIs) in accordance with American Society of Mechanical Engineers (ASME) Code, Section XI, Subsections IWB, IWC, and IWD. However, for flaws induced by intergranular stress corrosion cracking (IGSCC) in boiling-water reactor (BWR) austenitic piping, the NRC recommends augmented inspection schedules as described in Generic Letter (GL) 88-01, "NRC Positions on IGSCC in BWR Austenitic Piping." The augmented inspections scheduled in GL 88-01 are generally stricter than those specified in the ASME Code. In recent years, BWRVIP-75, "BWR Vessel and Internals Project Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules," proposed new industry guidelines on ISI schedules, accepted by the NRC, as modified by the staff, in a safety evaluation (SE) dated May 14, 2002. The staff's review of the flaw evaluations for the N2F recirculation nozzle, the recirculation nozzle thermal sleeves, and the CRDRL nozzle-to-cap weld is documented below.

CRDRL Nozzle-to-End Cap Weld. This flaw evaluation addresses a crack discovered in 2003 on the inside diameter of the weld connecting the CRDRL nozzle and the end cap. The control rod drive (CRD) cap was repaired by a non-ASME Code weld overlay without the defect ground out and the connection re-welded afterwards. As a result, there was a relief request to use certain portions of ASME Code Cases N-638, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique," and N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping." The SE granting the relief request was issued February 25, 2005.

The staff reviewed LRPD-06, the submittal, and the SE for the relief request and determined that the applicant needed to substantiate its conclusion on the CRDRL nozzle and the end cap flaw evaluation that, "This relief did not involve any analyses based on time-limited assumptions and therefore is not a TLAA." To resolve this need for substantiation, the staff issued Request for Additional Information (RAI) 4.3.1.2-1 dated September 7, 2006.

> Control rod drive (CRD) return line nozzle-to-end cap weld: Regarding the CRD return line nozzle-to-end cap weld repair, your project report LRPD-06, 'Pilgrim NPS License Renewal Project - Time Limited Aging Analyses, Mechanical Fatigue,' [Section] 2.4 refers to Relief Request PRR-36 and concludes, 'This relief did not involve any analyses based on time-limited assumptions and therefore is not a TLAA.' PRR-36 was submitted by letters dated October 1, 3, and 8, and July 12, 2004, for relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) requirements pertaining to the repair of the nozzle-to-end cap weld with a detected flaw and the associated nondestructive examinations. Alternatively, PRR-36 proposed to use ASME Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping," with modifications to perform the repair. The request was approved in a safety evaluation (SE) dated February 25, 2005. ASME Code Case N-504-2 (g)(2) requires a flaw evaluation be performed on the repaired component such that '[t]he evaluation should demonstrate that the requirements of IWB-3640...are satisfied for the design life of the repair, considering potential flaw growth due to fatigue and the mechanism believed to have caused the flaw. The

flaw growth evaluation shall be performed in accordance with Appendix C.' Explain how Entergy meets the ASME Code Case N-504-2 requirement of performing a flaw evaluation that considers fatigue and the mechanism believed to have caused the flaw. If applicable, you may provide a document showing that the weld overlay region adjacent to the interface is in the compressive stress zone.

In its response dated October 6, 2006, the applicant stated that fatigue crack growth for the flaw in the CRDRL nozzle-to-end cap weld is negligible because the only cycling is steam cycling with very few cycles over the life of the plant. This statement is consistent with the February 25, 2005, SE granting the relief request for the repair.

Based on its review, the staff finds the applicant's response to RAI 4.3.1.2-1 acceptable because, due to the simple nature of this qualitative crack growth analysis, to classify this flaw evaluation as a TLAA is unnecessary. The staff's concern described in RAI 4.3.1.2-1 is resolved.

For subsequent inspections, the applicant stated in its response, "reinspection of the repair will be per BWRVIP-75 Category E requirements which are to examine by UT [ultrasonic testing] 25% of Category E overlays every 10 years, and also to perform a UT exam within three refueling outages of the October 2003 repair." This statement is consistent with the proposed ISI in the relief request approved February 25, 2005, for the third 10-year ISI interval and appropriate for the period of extended operation.

<u>Recirculation Inlet Nozzles Thermal Sleeves</u>. This flaw evaluation addresses cracks discovered in 1984 on nine thermal sleeves on recirculation line inlet nozzles. As the flaw growth analysis in NEDC-30730 cited by the applicant is valid for only 18 months and the nature of the analyses in GENE-523-A143-1295 is not described in LRPD-06 to support exclusion of this issue from TLAAs, the staff issued RAI 4.3.1.2-2 dated September 7, 2006.

> Reactor recirculation nozzle thermal sleeves regarding the flaws in reactor recirculation nozzle thermal sleeves: LRPD-06 Response 2.4 refers to a flaw growth analysis in NEDC-30730 and concludes, 'The NRC reviewed and accepted the analysis as documented in an SER (Ref. 4.2.21). As this analysis is only based on 18 months, it is not a TLAA.' The cited SE was issued on December 4, 1984. As you stated, the crack growth analysis is for 18 months. One of the six criteria specified in 10 CFR 54.3(a) for classifying an analysis as a TLAA is the analysis '[i]nvolve time-limited assumptions defined by the current operating term, for example, 40 years.' The meaning of a crack growth analysis based on 18 months is that the structural integrity of reactor recirculation nozzle thermal sleeves is not only a concern for the period of extended operation but also a concern for the remaining period of operation under the current 40-year license. Therefore, Entergy needs to consider this as a TLAA and address the following:
>
> For the LRA:
>
> (1) Confirm whether Report PMA86-07, 'Pilgrim Nuclear Power Station Recirculation Inlet Thermal Sleeve Mock Up Fabrication and Evaluation,' dated October 1986 had been reviewed by the staff.

(2) Identify the SE which accepts use of hydrogen water chemistry [(HWC)] as the mitigating method and as the basis for Entergy to operate with the flaws on the thermal sleeves beyond 1987.

(3) Provide an analysis of the inspection results on these thermal sleeves obtained from 1987 to date.

(4) Provide the end-of-extended-period-of-operation (60 years) flaw length of the circumferential through-wall flaw which was determined to extend 32 percent around circumference of the recirculation inlet nozzle thermal sleeve (according to the December 4, 1984, SE for the worst flaw among the detected recirculation nozzle thermal sleeve cracks) and perform a stability analysis for this flaw.

(5) If the stability analysis of effort (4) shows that the predicted end-of-extended-period-of-operation through-wall flaw length does not meet the ASME Code, Section XI margin, provide an impact evaluation on operation and structural integrity of other components due to a broken thermal sleeve piece of a reasonable size.

(6) Provide an inspection plan for these detected thermal sleeve flaws in the period of extended operation.

For current operation till the end of 40-year operation:

(7) Discuss the adequacy of the inspection plan for recirculation nozzle thermal sleeves for the remaining period of 40-year operation.

(8) Provide the end-of-40-year-operation flaw length of the circumferential through-wall flaw which was determined to extend 32 percent around circumference of the recirculation inlet nozzle thermal sleeve and perform a stability analysis for this flaw.

In its response dated October 6, 2006, the applicant stated that a January 29, 1991, SE refers to Report PMA86-07 and that no SE accepts HWC as a mitigating method and as a basis for operation with the flaws on the thermal sleeves beyond 1987. This response answered RAI Items (1) and (2). On RAI Item (3), the applicant's October 6, 2006, response confirmed that there has been no subsequent inspection of the recirculation inlet thermal sleeves. Additionally, the applicant cited a April 26, 1990, SE on the applicant's response to GL 88-01 supporting continued operation of the unit. The staff has reviewed the conclusion of the April 26, 1990, SE: "the proposed IGSCC inspection and mitigation program will provide reasonable assurance of maintaining the long-term structural integrity of austenitic stainless steel piping at the Pilgrim Nuclear Power Station." The staff considers this SE conclusion the current NRC position on the structural integrity of PNPS austenitic stainless steel piping, including recirculation inlet nozzle thermal sleeves.

On the flaw evaluation stated in RAI Item (4), the applicant's response states that the flaw evaluation for the postulated flaw configuration (four through-wall cracks 2.94 inches long connected with 0.17 inch deep cracks in the remaining circumference) would be acceptable for an additional 65,000 hours of operation under normal water chemistry procedure implementation. The staff considers such information no longer applicable because the unit has been operated under HWC condition since 1986 and the postulated crack configuration may not be appropriate. Therefore, instead of demonstrating the thermal sleeve structural integrity, the applicant clarified that the thermal sleeve is not part of the reactor coolant pressure boundary (RCPB) and would not compromise it by failure due to cracking. The staff determined that this approach is acceptable if supported by an appropriate loose-part impact evaluation, requested in RAI Item (5), which also would make responses to RAI Items (6), (7), and (8) unnecessary because they relate to the fracture analysis and inspections. Consequently, classification of the recirculation inlet nozzle thermal sleeve cracking as a TLAA depends on whether fracture of these sleeves is a concern in the period of extended operation.

The applicant's response dated October 6, 2006, provides a loose part assessment:

> Failure of the thermal sleeve would be detected as a change in differential pressure of the affected jet pumps. There would be some slight movement but the thermal sleeves would remain within the nozzle. The movement of the riser pipe is restricted by the shroud. In addition, the cracks are at the outer end of the outer thermal sleeve. A full circumferential failure would not allow inward movement because the inner end of the outer thermal sleeve is welded to the nozzle and this would restrain movement.

The staff reviewed this response and determines that this loose part assessment addresses the impact of big ring pieces on the structural integrity of the surrounding and downstream piping and components. In a letter dated January 16, 2007, the applicant provided additional information to include an assessment of impact that smaller broken pieces would have on the structural integrity of the surrounding and downstream piping and components. The information provided by the applicant discusses the consequences that would result if larger pieces (over three inches in diameter) became lodged in the jet pump nozzle and if smaller pieces (less than three inches in diameter) pass through the jet pump nozzle and settle into the lower plenum of the reactor vessel. Other possible settling locations and their effects on operation were also examined by the applicant. Based on this analysis, the applicant concludes that loose parts would not present safety concern. The applicant's loose part analysis was based on information from BWRVIP-06-A, "BWR Vessel and Internals Project, Safety Assessment of BWR Reactor Internals (BWRVIP-06)." Although BWRVIP-06-A assesses the consequences of loose parts from a variety of reactor vessel internals, the assessment applies to loose parts from recirculation inlet nozzle thermal sleeves. Hence, the staff agrees with the applicant's conclusion that the loose parts present no safety concern and the fracture analysis of nozzle thermal sleeves is no longer the primary consideration. As stated in the October 6, 2006 response, "inspections will be performed per BWRVIP guides subject to availability of inspection techniques and equipment." Based on its review, the staff concludes the subject issue is not a TLAA. The staff's concern described in RAI 4.3.1.2-2 is resolved.

Recirculation Inlet Nozzle. This applicant flaw evaluation addresses a UT indication discovered in 2005 on the recirculation inlet nozzle (N2F) to safe end weld. The ISI summary report for Refueling Outage (RFO) 15 characterized this indication as a result of lack of fusion located mid-wall of the nozzle weld and created by the welding process during installation in 1984. The ISI summary report disposed of this indication as "accept-as-is" with no need for a flaw evaluation. As it did not rely on a time-limited analysis (in this case a quantitative flaw evaluation), the disposition of this indication is not a TLAA. The applicant has scheduled a re-examination for RFO 16 to confirm that there is no flaw growth. If the inspection results confirm that the flaw is not growing, the plant will revert to the original BWRVIP-75 inspection frequency. The plan for re-examination and future inspections for the recirculation inlet nozzle is in accordance with BWRVIP-75 guidance and, therefore, acceptable to the staff under the current operating license and appropriate for the period of extended operation.

4.1.2.2 Reactor Building Crane

The PNPS reactor building crane was procured to design specification Crane Manufacturers Association of America (CMAA)-70. The staff found that the applicant had not indicated the loading analysis for procurement of the reactor building crane as a TLAA for the LRA. The staff determined that the reactor building crane had TLAA potential for the LRA because CMAA-70 requires cyclical loading evaluations for some crane types procured to the design standard. LRA Section 2.4.2 states that the reactor building crane was categorized as a nonsafety-related Seismic II component. The staff asked the applicant to clarify whether a maximum-stress-allowable analysis for polar cranes was performed and whether it was a TLAA for the LRA.

In its July 5, 2006, response to the staff's question the applicant stated that whether CMAA-70 requires a maximum-stress-reduction fatigue analysis depends on the category for the crane. The applicant added that it had found no plant-specific loading analysis based on a "number-of-loading-cycle" time-limited parameter. The staff determined that the maximum-stress-level reduction-type fatigue analyses for CMAA-70 cranes were required for cranes categorized only for seismic Category I (*i.e.*, Service Class A-1) and procured to CMAA-70 design specifications but were categorized in the design basis as Seismic Category II. As the reactor building crane is categorized as seismic Category II, the staff concludes that it need not be within the scope of a CMAA-70-type TLAA analysis on metal fatigue.

4.1.2.3 Plant-Specific Exemptions

As required by 10 CFR 54.21(c)(2), the applicant must list all exemptions granted in accordance with 10 CFR 50.12, based on TLAAs, and evaluated and justified for continuation through the period of extended operation. The LRA states that each active exemption was reviewed to determine whether it was based on a TLAA. The applicant 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

On the basis of its review, the staff concludes that the applicant has provided an acceptable list of TLAAs, as required by 10 CFR 54.21(c)(1). The staff confirmed, as required by 10 CFR 54.21(c)(2), that no exemption to 10 CFR 50.12 had been granted based on a TLAA.

4.2 Reactor Vessel Neutron Embrittlement

During plant service, neutron irradiation reduces the fracture toughness of ferritic steel in the reactor vessel (RV) beltline region of the light-water nuclear power reactor. Areas of review for whether the RV and RV internals have adequate fracture toughness to prevent brittle failure during normal and off-normal operating conditions are (1) RV fluence, (2) operating pressure-temperature (P-T) limits for heatup and cooldown operations as well as hydrostatic and leak-testing conditions, (3) RV materials Charpy upper-shelf energy (C_VUSE) reduction due to neutron embrittlement (4) adjusted reference temperature (ART) for RV materials due to neutron embrittlement, (5) RV circumferential weld examination relief, (6) RV axial weld failure probability, and (7) reflood thermal shock of the RV internals. The adequacy of the analyses for these seven review areas is evaluated for the period of extended operation.

The ART is defined as the sum of the initial (unirradiated) reference temperature (RT_{NDT}), the mean value of the adjustment in reference temperature caused by irradiation (ΔRT_{NDT}), and a margin term (m). The ΔRT_{NDT} is the product of a chemistry factor (CF) and a fluence factor. The CF depends upon the amount of copper and nickel in the material and may be determined from tables in Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," or from surveillance data. The fluence factor depends upon the neutron fluence. The margin term depends upon whether the initial RT_{NDT} is a plant-specific or generic value and whether the CF was determined by the RG 1.99, Revision 2 Tables or by surveillance data. The margin term accounts for uncertainties in the initial RT_{NDT} values, the copper and nickel contents, the fluence, and the calculation methods. RG 1.99, Revision 2 describes the methodology for calculating the margin term. The mean RT_{NDT} is the sum of the initial RT_{NDT} and the ΔRT_{NDT} without the margin term. The mean RT_{NDT} and ART calculations meet 10 CFR 54.3(a) criteria for TLAAs. The P-T limits analysis uses ART values for the RV materials. The analyses of the circumferential weld examination relief and of the axial weld failure probability use mean RT_{NDT} values.

The staff uses 10 CFR Part 50, Appendix G criteria for maintaining acceptable C_VUSE levels for the RV beltline materials of operating reactors throughout the licensed lives of the facilities. The rule requires RV beltline materials to have a minimum C_VUSE value of 75 ft-lb in the unirradiated condition and a minimum C_VUSE value above 50 ft-lb throughout the life of the facility, unless lower values of C_VUSE can be demonstrated through analysis to provide acceptable margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code. The rule also mandates that the methods used to calculate C_VUSE values must account for the effects of neutron irradiation on C_VUSE values for the materials and must incorporate any relevant RV surveillance capsule data reported through implementation of a plant's 10 CFR Part 50, Appendix H RV material surveillance program. RG 1.99, Revision 2 addresses the calculation of C_VUSE values expansively and describes two methods for determining them for RV beltline materials depending on whether an RV beltline material is represented in the plant's RV material surveillance (i.e., 10 CFR Part 50, Appendix H) program. If surveillance data is not available, determination of the C_VUSE value is in accordance with position 1.2 of RG 1.99, Revision 2. If surveillance data is available, the determination should be in accordance with position 2.2. These methods refer to RG 1.99, Revision 2, Figure 2, which describes how the percentage drop in C_VUSE depends upon the amount of copper in the material and the neutron fluence. As the analyses according to 10 CFR Part 50, Appendix G are based on a flaw with a depth equal to one-quarter of the vessel wall thickness (1/4T), the neutron fluence in the C_VUSE analysis is that at the 1/4T depth location in the RV wall.

The applicant described its evaluation of these TLAAs in LRA Section 4.2, "Neutron Embrittlement of the Reactor Vessel and Internals," and in LRA Section 4.7, "Other Plant-Specific TLAA." The applicant included a discussion of the following topics related to neutron embrittlement in LRA Sections 4.2 and 4.7:

- Reactor Vessel Neutron Fluence (LRA Section 4.2.1)
- Pressure-Temperature Limits (LRA Section 4.2.2)
- Charpy Upper-Shelf Energy (LRA Section 4.2.3)
- Adjusted Reference Temperature (LRA Section 4.2.4)
- Reactor Vessel Circumferential Weld Examination Relief (LRA Section 4.2.5)
- Reactor Vessel Axial Weld Failure Probability (LRA Section 4.2.6)
- Reflood Thermal Shock of the Reactor Vessel Internals (LRA Section 4.7.1)

The staff found the RV Fluence TLAA evaluation in Section 4.2.1 of the original LRA unacceptable due to the lack of benchmarking data in support of the plant-specific fluence calculations and, therefore, the neutron fluence values from LRA Section 4.2.1 unacceptable for use in the RV and RV internals neutron embrittlement TLAAs. The was identified as Open Item (OI) 4.2 in the SER with OI issued in March 2007.

In RAI 4.2 dated March 26, 2007, the staff clarified OI 4.2 as follows:

(1) Fluence was calculated for the Pilgrim reactor vessel (RV) for the extended 60-year licensed operating period (54 effective full power years (EFPY) of facility operation), using the Radiation Analysis Modeling Application (RAMA) fluence methodology. The RAMA fluence methodology was previously approved by the NRC staff, and the results are acceptable for licensing actions provided that: (1) the RAMA application follows the guidance in Regulatory Guide 1.190 and (2) RV fluence calculations have at least one credible plant-specific surveillance capsule for benchmarking.

The applicant provided 54 EFPY fluence values for the Pilgrim RV beltline materials in LRA Section 4.2.1. These fluence values were used throughout LRA Section 4.2 for the RV neutron embrittlement time limited aging analyses (TLAAs). However, due to the lack of a credible plant-specific benchmark, the staff finds the 54 EFPY fluence values provided in LRA Section 4.2.1 unacceptable for use in the RV neutron embrittlement TLAAs. Therefore, the staff requests that the applicant revise LRA Section 4.2.1 to provide an acceptable neutron fluence evaluation or an alternative proposal for closing this TLAA topic in the LRA review.

(2) Due to the lack of benchmarking data in support of the plant-specific RAMA fluence calculations, the staff cannot complete its review of the TLAAs in LRA Sections 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, and 4.7.1, as well as the

aging management program (AMP) on the RV material surveillance program, using the current fluence values for the Pilgrim RV that were *provided in* LRA *Section* 4.2.1. *Therefore, the staff requests that the* applicant revise LRA Sections 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, 4.7.1, and the AMP on the RV material surveillance program to provide an acceptable evaluation of these topics or an alternative proposal for closing these topics in the LRA review.

In its response dated May 17, 2007, the applicant stated:

The benchmarking validation of the RAMA fluence calculation is ongoing for the Pilgrim reactor vessel and internals. The RAMA calculated fluence is approximately 56% of the benchmark fluence calculated from the available surveillance capsule dosimetry. Uncertainties between the calculated and measured results from the dosimetry are still being examined to determine a possible cause for the discrepancy. To ensure resolution of this issue, Commitment 47, which reads as follows, is added by this letter.

47. On or before September 15, 2007, submit to the NRC an action plan to improve benchmarking data to support approval of new P-T curves for Pilgrim.

To address this issue, an alternative analysis is provided as a means to close this TLAA topic in the LRA review. To address fluence-related TLAAs for the period of extended operation, Entergy has evaluated the affected TLAAs to determine the limiting fluence value. The evaluation included information presented in LRA Sections 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, 4.7.1, and the AMP on the RV material surveillance program. From this evaluation the limiting fluence was determined. The alternative analysis to determine the limiting fluence value is included as Attachment E.

This analysis assumes increasing fluence levels until an ASME Code or regulatory limit is reached based on the projected changes in material properties. Changes in the vessel (ferritic) steel material properties are measured by an increase in adjusted reference temperature or a decrease in Charpy upper-shelf energy. The effects of increasing fluence on the austenitic stainless steel core shroud and internals was also considered. By assuming increasing fluence levels, the analysis identifies the maximum fluence that can be experienced while meeting the Code and regulatory criteria. This analysis also shows that there is a large margin available to this limiting fluence at the end of the period of extended operation.

The analysis determined that the limiting fluence value was set by a maximum mean RT_{NDT} value for the axial weld failure probability of 114 °F, in order for the axial weld failure frequency to remain below 5×10^{-6} per reactor operating year. The corresponding maximum allowable ID fluence for the RV axial welds was determined to be 3.37×10^{18} n/cm^2. If the fluence remains below this limiting value during the period of extended operation, the fluence will result in acceptable results for all fluence-related TLAAs. To confirm that the limiting fluence will not be reached during the period of extended operation and consequently that all of the fluence-related TLAAs remain valid, Commitment 48, which reads as follows, is added by this letter.

48. On or before June 8, 2010, Entergy will submit to the NRC calculations consistent with Regulatory Guide 1.190 that will demonstrate limiting fluence values will not be reached during the period of extended operation.

Entergy would find it acceptable if this commitment became a license condition. It should be noted that at the ACRS meeting on April 4, 2007, reference was made to EPRI research that investigated the irradiated behavior of stainless steel components in order to predict service life. Further review has shown that the predictions of service life related to fluence are not directly relevant in this case. The core shroud and the top guide are components that are susceptible to aging effects. However, a review of the analyses related to the core shroud found that the only time-limited aging analysis (TLAA) involves the fatigue analysis and calculation of cumulative usage factors (CUFs) for the shroud repair. The core shroud does not affect the operating P-T limit curves and there is no criterion on fluence that would further limit the operation of the core shroud structure. Similarly, the top guide does not affect the operating P-T limit curves, and there is no criterion on fluence that would further limit the operation of the top guide structure.

PNPS has re-evaluated the neutron embrittlement issues of Sections 4.2 and 4.7.1... The Reactor Vessel Material Surveillance Program, with the changes to the fluence extrapolation, is correct as written, and no changes to Appendix B, Section B.1.26 are necessary.

The staff determined that an acceptable response by the applicant to RAI 4.2 would resolve OI 4.2 because the questions clarified what was required to resolve it. The staff evaluation of the applicant's response to RAI 4.2 follows.

As part of its response to RAI 4.2(1), the applicant added Commitment 47 to resolve the fluence calculation benchmarking issue. Commitment 47 states that on or before September 15, 2007, an action plan to improve fluence benchmarking data to support staff approval of new P-T limit curves will be submitted.

In addition to Commitment 47, the applicant provided in its response to RAI 4.2 an alternative analysis to close the RV and RV internals neutron embrittlement TLAA topics. These TLAA topics are dependent on benchmarked neutron fluence values. As the original LRA (submitted on January 27, 2006) Section 4.2.1 fluence values were unacceptable, the staff determined that an alternative method for closing these fluence-dependent TLAA topics was required. The applicant stated that this alternative method evaluated all fluence-dependent TLAAs to determine a limiting fluence value representing the highest that can be permitted at the end of the period of extended operation before reaching a regulatory or operational limit for any of the TLAAs. The applicant stated that this evaluation addressed the TLAAs in Sections 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, and 4.7.1 and the AMP on the RV material surveillance program from the original LRA. The staff found the applicant's alternative method for determining a limiting fluence for all fluence-dependent TLAAs appropriate for closing these TLAA topics because it would confirm that all fluence-dependent TLAAs will remain valid when benchmarked fluence data becomes available.

The applicant provided the alternative analysis for determining the limiting fluence value in Attachment E to its response to OI 4.2 and RAI 4.2(2). The analysis determined the limiting fluence value by back-calculating the maximum fluence for each TLAA permissible for the TLAA to remain acceptable at the end of the period of extended operation 54 EFPY). Specifically, for a given fluence-dependent TLAA, regulatory criteria for license renewal was used to establish a limiting threshold material parameter that cannot be exceeded by the end of the period of extended operation or, for operating P-T limits, the applicant specified a practical operational limit. By establishing a limiting threshold material parameter and using available material chemistry data, the applicant back-calculated maximum allowable 54 EFPY fluence for each TLAA, then selected the lowest fluence value and designated it as the most limiting fluence for all fluence dependant TLAAs. The staff found this method appropriate for determining the limiting fluence because it allows the TLAAs to be projected through the period of extended operation. Future neutron fluence evaluations will confirm the TLAA results.

The staff reviewed and evaluated the applicant's limiting fluence back-calculation by performing an independent calculation of this limiting fluence value based on RV beltline material properties from the original LRA sections and previously established regulatory criteria for license renewal or, for operating P-T limits, on a practical operational limit specified by the applicant. The staff's independent calculations confirmed the results of the applicant's alternative analysis in Attachment E of its response to OI 4.2 and RAI 4.2(2) for determining the limiting fluence value for all fluence-dependent TLAAs. A brief summary of the staff's findings on the applicant's analysis for determining this limiting fluence value follows.

For the TLAAs of the RV material ART and the operating P-T limits (LRA Sections 4.2.4 and 4.2.2), the applicant determined the maximum allowable 54 EFPY fluence by back-calculating the maximum fluence that could be permitted for hydrostatic/leak testing of the reactor coolant system (RCS) at 212 °F, a value the applicant chose for the hydrostatic/leak test as the limiting condition for these TLAAs because it represents a practical BWR operational limit. Based on this temperature, the staff determined that the applicant correctly back-calculated the maximum allowable ART value for the limiting RV beltline material using the fracture toughness criteria from ASME Code Section XI, Appendix G, as required by 10 CFR Part 50, Appendix G. Using this maximum allowable ART value, RV material chemistry data, and other data from the original LRA, the applicant correctly determined that the maximum allowable value for the fluence at the RV 1/4T location was 4.12×10^{18} n/cm^2 (E > 1.0 MeV) for the limiting material. The corresponding fluence at the RV inner surface was determined to be 5.8×10^{18} n/cm^2 (E > 1.0 MeV).

For the TLAA of the C_VUSE (LRA Section 4.2.3), the applicant determined the maximum allowable 54 EFPY fluence by setting the minimum permissible upper-shelf energy (USE) value at end of life (EOL) to be 50 ft-lb of absorbed energy, the lowest USE value at EOL permitted by 10 CFR Part 50, Appendix G. From available data for the initial USE (the unirradiated USE values previously known from the beginning of plant life) the applicant correctly determined that the maximum allowable USE percentage decrease over the course of the period of extended operation (54 EFPY) would be 33.3 percent. Using this maximum value for the percentage USE decrease and material chemistry data from the original LRA submission, the staff found that the applicant correctly determined that the maximum allowable fluence value at the 1/4T location was 7.10×10^{18} n/cm^2 (E > 1.0 MeV) for the limiting material using the procedures of RG 1.99, Revision 2 for USE calculations. The corresponding fluence at the RV inner surface was determined to be 1.00×10^{19} n/cm^2 (E > 1.0 MeV).

For the TLAA of the RV circumferential weld examination relief (LRA Section 4.2.5), the applicant determined the maximum allowable 54 EFPY fluence by setting the maximum allowable 54 EFPY mean RT_{NDT} value for the limiting circumferential weld at 128.5°F, a value from Table 2.6-5 of the July 28, 1998, SER for the BWRVIP-05 report, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05)," established by the staff as an acceptable threshold value for the limiting circumferential weld mean RT_{NDT} based on a determination of the RV circumferential weld conditional failure probability. Using this maximum value for the circumferential weld mean RT_{NDT} and material chemistry data from the original LRA, the staff found that the applicant correctly determined that the maximum allowable value for the fluence at the RV inner surface was 1.14×10^{19} n/cm^2 (E > 1.0 MeV) for the limiting circumferential weld using the procedures of RG 1.99, Revision 2 for mean RT_{NDT} calculations.

For the TLAA of the RV axial weld failure probability (LRA Section 4.2.6), the applicant determined the maximum allowable 54 EFPY fluence by setting the maximum allowable 54 EFPY mean RT_{NDT} value for the limiting axial weld at 114°F, a value from Table 3 of the March 7, 2000, supplemental SER for BWRVIP-05 and established by the staff in the SER for the BWRVIP-74 report, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines (BWRVIP-74)," as an acceptable threshold value for the limiting axial weld mean RT_{NDT} based on a determination of the RV axial weld failure frequency, assuming that eventually the applicant would seek relief from RV circumferential weld examinations for the extended license term. Using this maximum value for the axial weld mean RT_{NDT} and material chemistry data from the original LRA submittal, the staff found that the applicant correctly determined that the maximum allowable value for the fluence at the RV inner surface was 3.37×10^{18} n/cm^2 (E > 1.0 MeV) for the limiting axial weld using the procedures of RG 1.99, Revision 2 for mean RT_{NDT} calculations.

For the TLAA of the reflood thermal shock of the RV internals (LRA Section 4.7.1), the applicant determined that this evaluation as a fluence-dependent TLAA is based on core shroud material properties affected by neutron fluence. The applicant stated that the core shroud material is Type 304 stainless steel, which is not affected significantly by irradiation. The BWRVIP-35 report concluded that the service limit of Type 304 stainless steel is approached at a fluence of 8×10^{21} n/cm^2 (E > 1.0 MeV). The staff found that by setting the maximum allowable 54 EFPY fluence at the core shroud inner surface at 8×10^{21} n/cm^2 (E > 1.0 MeV), the corresponding fluence at the RV inner surface would be significantly greater than 3.37×10^{18} n/cm^2 (E > 1.0 MeV). Therefore, the value of 3.37×10^{18} n/cm^2 (E > 1.0 MeV) based on RV axial weld failure probability TLAA is the most limiting fluence value for all RV neutron embrittlement TLAAs. Based on this finding, the staff concluded that the applicant correctly determined that for the TLAA of the reflood thermal shock of the RV internals the maximum allowable core shroud fluence is non-limiting.

The staff found that the applicant correctly concluded that the limiting fluence for all fluence-dependent TLAAs is 3.37×10^{18} n/cm^2 (E > 1.0 MeV) based on the TLAA for the RV axial weld conditional failure probability because it is the lowest value of the maximum allowable 54 EFPY fluence for all fluence-dependent TLAAs. The staff concluded that the TLAAs had therefore been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). To confirm that this limiting fluence will not be reached at end of the period of extended operation and that all fluence-dependent TLAAs remain valid, the applicant added, in response to OI 4.2 and RAI 4.2(2), Commitment 48, which reads as follows:

> Commitment 48: On or before June 8, 2010, Entergy will submit to the NRC calculations consistent with RG 1.190 that will demonstrate limiting fluence values will not be reached during the period of extended operation.

The staff finds that the applicant's analysis for determining the limiting fluence value for all fluence-dependent TLAAs, with Commitments 47 and 48, resolves RAI 4.2 because a suitable means has been established for conclusively confirming that all fluence-dependent TLAAs will remain valid when benchmarked fluence data becomes available prior to the beginning of the period of extended operation. As discussed previously, the staff determined that the resolution of RAI 4.2 satisfies OI 4.2. The staff concludes that OI 4.2 is closed.

The applicant has re-evaluated the fluence-dependent TLAAs of LRA Sections 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, and 4.7.1 based on determination of the limiting fluence value. The applicant submitted revisions to these LRA sections as well as revised UFSAR supplement sections for these TLAAs by letter dated May 17, 2007, as part of its response to OI 4.2. These revised LRA sections and corresponding UFSAR supplement sections supersede Sections 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, and 4.7.1, as well as the corresponding UFSAR supplement sections from the original LRA. The applicant used the alternative analysis for determining the limiting fluence (the alternative limiting fluence analysis) and Commitment 48 to close out the TLAAs in these revised LRA sections. Staff evaluations and conclusions for each of the following TLAAs are based on revised LRA Sections 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, and 4.7.1; however, where appropriate, the staff considers supporting material property information from the original LRA because this information was unchanged by the revised LRA sections and forms part of the basis for closing out these TLAAs.

4.2.1 Reactor Vessel Fluence

4.2.1.1 Summary of Technical Information in the Application

LRA Section 4.2.1 summarizes the evaluation of RV fluence for the period of extended operation. Calculated fluence based on a time-limited assumption defined by the period of operation is the time-limited assumption for the TLAAs that evaluate RV neutron embrittlement. Fluence values were calculated according to the RAMA fluence methodology developed for the Electric Power Research Institute, Inc., and the BWRVIP to calculate neutron fluence in BWR components. The staff has approved this methodology for application in RG 1.190. At PNPS, the limiting beltline materials for 40 years consist of six plates and their connecting welds, all adjacent to the active fuel zone. No nozzles are included in the limiting beltline materials for the current term of operation. The beltline was re-evaluated for 60 years. The fluence calculation shows that the reactor recirculation inlet nozzles will exceed 1×10^{17} n/cm^2 (E > 1 mega-electron volt (MeV)) at 54 EFPY (1/4 T fluence = 2.02×10^{17} n/cm^2 (E > 1 MeV)), remaining well below the 8.4×10^{17} n/cm^2 (E > 1 MeV) 1/4 T fluence incurred by the limiting plates and welds in the vessel. An evaluation of the reference temperature nil ductility (RT_{NDT}) for these nozzle forgings and welds shows that their adjusted reference temperature (ART) at 54 EFPY will be well below the ARTs determining P-T limits. Thus, the nozzle forgings and welds are not the limiting items for the period of extended operation.

4.2.1.2 Staff Evaluation

The RAMA fluence methodology was previously approved by the staff with the condition that any license holders or license renewal applicants proposing to implement it for calculating RV fluence values would need to use at least one credible plant-specific surveillance capsule for calculation benchmarking.

Reactor vessel fluence was calculated for the extended 60-year licensed operating period (54 EFPY) using the RAMA fluence methodology. In LRA Section 4.2.1 the applicant provided 54 EFPY fluence values for the RV beltline materials. These fluence values were used throughout LRA Section 4.2 for the RV neutron embrittlement calculations, however, due to the lack of benchmarking data in support of the plant-specific RAMA fluence calculations, the staff found these fluence values unacceptable for use in the RV neutron embrittlement TLAAs in LRA Sections 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, as well as in the RV internals reflood thermal shock TLAA in LRA Section 4.7.1. Therefore, the staff did not complete its review of this and all other neutron embrittlement TLAAs. The review for conclusively determining regulatory compliance became contingent upon receipt of modified fluence values based on acceptable benchmarking of RAMA fluence calculations and modified TLAAs that utilize acceptable fluence values. This item was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant revised LRA Section 4.2.1 to state that the benchmarking validation of the RAMA fluence calculation is ongoing for the RV. The applicant indicated that the RAMA calculated fluence is approximately 56 percent of the benchmark fluence calculated from the available surveillance capsule dosimetry; however, this available surveillance capsule dosimetry was not acceptable for calculating the required benchmark fluence. The applicant is examining uncertainties between the calculated and measured results from the dosimetry for the cause for the discrepancy. The applicant added Commitment 47, which requires a plan for resolving this discrepancy to be submitted for staff review by September 15, 2007.

The applicant addressed, in revised LRA Section 4.2.1, the application of the alternative limiting fluence analysis for closing out this TLAA. The staff reviewed and evaluated this analysis as reported in SER Section 4.2 and determined that it provided an acceptable basis for closing out the RV fluence TLAA in revised LRA Section 4.2.1. The applicant determined the limiting fluence value for all fluence-dependent TLAAs to be 3.37×10^{18} n/cm^2 ($E > 1$ MeV) for the lower intermediate shell axial welds at the RV inner surface. The staff concluded that the TLAAs had therefore been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The applicant, as part of its resolution of OI 4.2, added Commitment 48 to confirm, by June 8, 2010, that the limiting fluence will not be reached during the period of extended operation.

The staff finds the TLAA for the RV fluence acceptable in accordance with 10 CFR 54.21(c)(1)(ii). As stated in Section 4.2, the staff has reviewed and accepted Commitment 48 and the alternative limiting fluence analysis for resolving OI 4.2 and confirming the results of the TLAAs. Commitment 48 is hereby superseded by License Condition 4.2.6. This license condition is addressed in SER Section 4.2.6. The staff, therefore, concludes that OI 4.2 is closed.

4.2.1.3 UFSAR Supplement

The applicant provided in LRA Section A.2.2.1.1 an UFSAR supplement summary description of its TLAA for the RV fluence. The staff could not complete the review until receipt of a revised LRA Section A.2.2.1.1 documenting the revised TLAA. This item was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant revised LRA Section A.2.2.1.1 to include the following UFSAR supplement summary description for the TLAA of the RV fluence:

> Calculated fluence is based on a time-limited assumption defined by the operating term. As such, fluence is the time-limited assumption for the TLAAs that evaluate reactor vessel neutron embrittlement. Fluence values were calculated using the RAMA fluence methodology. The RAMA fluence methodology was developed for the Electric Power Research Institute, Inc. and the boiling water reactor vessel and internals project (BWRVIP) for the purpose of calculating neutron fluence in boiling water reactor components. This methodology has been approved by the NRC for application in accordance with RG 1.190 provided the fluence calculations for the reactor are appropriately benchmarked.
>
> The benchmarking validation of the RAMA fluence calculation is ongoing for the Pilgrim reactor vessel. The RAMA calculated fluence is approximately 56% of the benchmark fluence calculated from the available surveillance capsule dosimetry. Uncertainties between the calculated and measured results from the dosimetry are still being examined to determine a possible cause for the discrepancy. An action plan to improve benchmarking data to support approval of new P-T limit curves will be developed and submitted for NRC review.
>
> An alternative analysis to determine the limiting fluence value has been performed. This analysis assumes increasing fluence levels until an ASME Code or regulatory limit is reached based on the projected changes in material properties. Changes in the vessel (ferritic) steel material properties are measured by an increase in adjusted reference temperature or a decrease in Charpy upper-shelf energy. The effects of increasing fluence on the austenitic stainless steel core shroud and internals was also considered. By assuming increasing fluence levels, the analysis identifies the maximum fluence that can be experienced while meeting the Code and regulatory criteria.
>
> The alternative limiting fluence analysis determined that the limiting fluence value is set by the maximum mean RT_{NDT} value for the vessel axial welds of 114 °F to remain below [or equal to] a calculated reactor vessel failure frequency of 5×10^{-6}... per reactor year. The corresponding maximum allowable ID fluence for the axial welds was determined to be 3.37×10^{18} n/cm^2. This fluence is the limiting fluence value identified.
>
> On or before June 8, 2010, Entergy will submit to the NRC calculations consistent with RG 1.190 that will demonstrate limiting fluence values will not be reached during the period of extended operation.

The applicant's revised UFSAR supplement summary description for the TLAA of the RV fluence appropriately describes how the applicant applied the alternative limiting fluence analysis described in SER Section 4.2 to close out this TLAA. The applicant's UFSAR supplement summary description is consistent with the staff analysis for the TLAA of the RV fluence in SER Section 4.2.1.2. Based on this assessment, the staff finds the UFSAR supplement summary description for the TLAA of the RV fluence acceptable. The staff concludes that OI 4.2 is closed.

4.2.1.4 Conclusion

The staff has reviewed the applicant's TLAA of the RV fluence as summarized in revised LRA Section 4.2.1 and has determined that the RV fluence TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). License Condition 4.2.6 has been imposed to confirm the results of the applicant's calculation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA for the RV fluence for the period of extended operation, as required by 10 CFR 54.21(d).

4.2.2 Pressure-Temperature Limits

4.2.2.1 Summary of Technical Information in the Application

LRA Section 4.2.2 summarizes the evaluation of P-T limits for the period of extended operation. Appendix G of 10 CFR Part 50 requires RV bolt-up, hydrotest, pressure tests, normal operation, and anticipated operational occurrences within established P-T limits established by calculations that utilize the materials and fluence data from the Reactor Vessel Surveillance Program. In 2000, the applicant requested a license amendment to change the P-T limits to account for 20, 32, and 48 EFPY of operation but the staff concluded that the fluence values based on an outdated calculation method were not credible and approved the limits for use only through Operating Cycle 14. In 2002, the applicant requested an extended use of these curves through the end of Cycle 15. The applicant then submitted changes to this request, including use of the present curves through the end of operating Cycle 16 (corresponding to approximately 23 EFPY, expected to occur in 2007), so it could benefit from data gathered through the BWRVIP Integrated Surveillance Program/Supplemental Surveillance Program. In this submission, the applicant committed to develop and present prior to the end of operating Cycle 16 updated P-T limit curves and revised fluence calculations based on a staff-approved calculation method that adheres to RG 1.190. License Amendment 197 granted this request in 2003. Recent fluence calculations, per RG 1.190, confirm that the fluence for 54 EFPY is less than that for the calculation of the P-T limits. Consequently, the current technical specification P-T limits remain valid for the period of extended operation.

The staff issued License Amendment 227 to the applicant on March 29, 2007. Amendment 227 extended the existing P-T limit curves through Operating Cycle 18.

The P-T limit curves will continue to be updated as required by Appendix G of 10 CFR Part 50 or by operational needs. This updating will assure that the operational limits remain valid through the period of extended operation. Maintaining the P-T limit curves in accordance with Appendix G of 10 CFR Part 50 assures adequate management of the effects of aging on the intended function(s) for the period of extended operation consistent with 10 CFR 54.21(c)(1)(ii).

4.2.2.2 Staff Evaluation

The staff reviewed original LRA Section 4.2.2 to evaluate the acceptability of the applicant's analysis pursuant to 10 CFR 54.21(c)(1). Due to the lack of benchmarking data in support of the plant-specific RAMA fluence calculations, the staff was unable to authorize the 54 EFPY fluence values for use in support of the TLAA for the P-T limits. This was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant included a revised LRA Section 4.2.2 that addressed operating P-T limits for the RV. The applicant cited the requirements of 10 CFR Part 50, Appendix G for determining operating P-T limits for three categories of operation: (1) hydrostatic pressure tests and leak tests, (2) non-nuclear heatup and cooldown operations, including low-level reactor physics tests, and (3) core critical operations. The applicant stated that the RV P-T limits are established by calculations that utilize the materials and fluence data from the RV Surveillance Program.

The staff issued License Amendment 227 to the applicant on March 29, 2007, extending the existing P-T limit curves through the end of Operating Cycle 18. The applicant stated that the P-T limit curves for the RV will continue to be updated in accordance with the requirements of 10 CFR Part 50, Appendix G through the period of extended operation. P-T limit curves valid for the extended license term will be submitted prior to the end of the current license term.

As reported in SER Section 4.2, the applicant determined the maximum allowable 54 EFPY fluence for this TLAA and the RV materials ART TLAA (LRA Section 4.2.4) by back-calculating the maximum fluence permitted for hydrostatic/leak testing of the RCS at 212 °F. The applicant chose the 212 °F value for the hydrostatic/leak test as the limiting condition for these TLAAs because it represents a practical BWR operational limit. Based on this temperature, the applicant correctly back-calculated the maximum allowable ART value for the limiting RV beltline material using the fracture toughness criteria from ASME Code, Section XI, Appendix G, as required by 10 CFR Part 50, Appendix G. Using this maximum allowable ART value, RV material chemistry data, and other data from its original LRA, the applicant correctly determined that the maximum allowable value for the fluence at the RV 1/4T location was 4.12×10^{18} n/cm^2 (E > 1.0 MeV) for the limiting material. The corresponding fluence at the RV inner surface was determined to be 5.8×10^{18} n/cm^2 (E > 1.0 MeV).

In its May 17, 2007 letter, the applicant provided an alternative limiting fluence analysis for closing out this TLAA. The staff reviewed and evaluated this analysis as reported in SER Section 4.2 and determined that it provides in revised LRA Section 4.2.2 an acceptable basis for closing out the TLAA for the P-T limits. The applicant determined the limiting fluence value for all fluence-dependent TLAAs to be 3.37×10^{18} n/cm^2 (E > 1.0 MeV) for the lower intermediate shell axial welds at the RV inner surface. The staff concluded that the TLAAs had therefore been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The applicant, as part of its resolution of OI 4.2, added Commitment 48 to confirm, by June 8, 2010, that the limiting fluence will not be reached during the period of extended operation.

The staff finds the TLAA for the P-T limits acceptable in accordance with 10 CFR 54.21(c)(1)(ii).

As reported in Section 4.2, the staff has reviewed and accepted Commitment 48 and the alternative fluence analysis for resolving OI 4.2 and confirming the results of the TLAAs. Commitment 48 is hereby superseded by License Condition 4.2.6 addressed in SER Section 4.2.6. The staff, therefore, concludes that OI 4.2 is closed.

4.2.2.3 UFSAR Supplement

The applicant provided in LRA Section A.2.2.1.2 an UFSAR supplement summary description of its TLAA for the RV fluence. The staff could not complete the review until receipt of a revised LRA Section A.2.2.1.2 documenting the revised TLAA. This item was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant revised LRA Section A.2.2.1.2 to include the following UFSAR Supplement summary description for the TLAA of P-T limits:

> Appendix G of 10 CFR 50 requires that reactor vessel boltup, hydrotest, pressure tests, normal operation, and anticipated operational occurrences be accomplished within established P-T limits. These limits are established by calculations that utilize the materials and fluence data obtained through the Reactor Vessel Surveillance Program.
>
> PNPS received License Amendment 227 dated March 29, 2007, that extended the existing P-T limit curves for PNPS through Operating Cycle 18.
>
> The P-T limit curves will continue to be updated, as required by Appendix G of 10 CFR Part 50 or as operational needs dictate. This updating will assure that the operational limits remain valid through the period of extended operation. Maintaining the P-T limit curves in accordance with the requirements Appendix G of 10 CFR 50 Part 50 assures that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation, consistent with 10 CFR 54.21(c)(1)(iii).

The applicant's revised UFSAR supplement summary description for the TLAA of the P-T limits appropriately describes how the applicant will update the P-T limits during the period of extended operation. Based upon the staff's conclusion, the applicant shall update its UFSAR to reflect the closure of the TLAA consistent with 10 CFR 54.21(c)(1)(ii) instead of 10 CFR 54.21(c)(1)(iii). With this change, the applicant's UFSAR supplement summary description will be consistent with the staff analysis for the TLAA of the P-T limits in SER Section 4.2.2.2. Based on this assessment, the staff finds the UFSAR supplement summary description for the TLAA of the P-T limits acceptable. The staff concludes that OI 4.2 is closed.

4.2.2.4 Conclusion

The staff has reviewed the applicant's TLAA of the P-T limits as summarized in revised LRA Section 4.2.2 and has determined that the P-T limits TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). License Condition 4.2.6 has been imposed to confirm the results of the applicant's calculation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA for the P-T limits 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

LRA Section 4.2.3 summarizes the evaluation of C_VUSE for the period of extended operation. Part 50 of 10 CFR, Appendix G, requires that RV beltline materials "have Charpy upper-shelf energy ... of no less than 75 ft-lb initially and must maintain Charpy upper-shelf energy throughout the life of the vessel of no less than 50 ft-lb." The applicant provided the staff with initial (unirradiated) C_VUSE values for beltline welds in correspondence responding to GL 92-01. RG 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," states two positions in determining C_VUSE. Position 1 applies to material without surveillance data and Position 2 to material with a minimum of two sets of credible material surveillance data. As PNPS has data from only one material surveillance capsule, Position 2 does not apply. Position 1 determines the C_VUSE percentage drop for a stated copper content and neutron fluence by reference to Figure 2 of RG 1.99, Revision 2, and applies it to the initial C_VUSE to obtain the adjusted C_VUSE. The predictions for percentage drop in C_VUSE at 54 EFPY are based on chemistry data, the maximum 1/4 T fluence values, and unirradiated C_VUSE data submitted in response to GL 92-01. The predictions of C_VUSE values for 54 EFPY used RG1.99, Position 1, Figure 2, specifically, the formula for the lines to calculate the C_VUSE percent drop.

Using chemistry data from previous licensing submissions, the applicant's response to GL 92-01, and the 1/4 T fluence values, linear interpolation on the C_VUSE percentage drop values in RG 1.99, Revision 2, Figure 2, projected all C_VUSE values to remain well above the 50 ft-lb requirement for the period of extended operation. As such, this TLAA has been projected to the end of the period of extended operation.

4.2.3.2 Staff Evaluation

The staff reviewed original LRA Section 4.2.3 to evaluate the acceptability of the applicant's analysis pursuant to 10 CFR 54.21(c)(1). Due to the lack of benchmarking data in support of the plant-specific RAMA fluence calculations, the staff was unable to authorize the 54 EFPY fluence values for use in support of the TLAA for the C_VUSE. This was identified as OI 4.2 in the SER with OI issued in March 2007.

Section IV.A.1.a of Appendix G to 10 CFR Part 50 requires, in part, that RV beltline materials have Charpy USE values of no less than 50 ft-lb in the transverse direction for base metal and along the weld for weld material unless lower CvUSE values can be demonstrated in a manner approved by the Director, Office of Nuclear Reactor Regulation, to ensure margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

According to RG 1.99, Revision 2, the predicted decrease in USE due to neutron embrittlement during plant operation depends upon the amount of copper in the material and the predicted neutron fluence for the material. Position 1 of RG 1.99, Revision 2, specifies methods for calculating the predicted decrease in USE for materials without sufficient credible surveillance data. The staff determined that the applicant correctly cited Position 1 of RG 1.99, Revision 2 as the correct method for calculating the predicted USE percentage decrease for the period of extended operation because only one credible set of surveillance data is available for the RV. Furthermore, as reported in SER Section 4.2, the applicant correctly utilized Position 1 for the maximum fluence back-calculation for this TLAA as part of its analysis for determining the limiting fluence value.

Initial (unirradiated) USE values were available for all RV beltline materials under consideration. The staff confirmed that the initial USE values were based appropriately on the applicant's response to GL 92-01. As reported in SER Section 4.2, the applicant appropriately utilized these initial USE values, along with chemistry data from Table 4.2-1 of the original LRA and the USE acceptance criterion of 50 ft-lb at EOL from 10 CFR Part 50, Appendix G, for the maximum fluence back-calculation for this TLAA as part of its analysis for determining the limiting fluence.

In its May 17, 2007 letter, the applicant provided an alternative limiting fluence analysis for closing out this TLAA. The staff reviewed and evaluated this analysis as reported in SER Section 4.2 and determined that it provides in revised LRA Section 4.2.3 an acceptable basis for closing out the TLAA for the RV materials USE. The limiting fluence value for all fluence-dependent TLAAs was determined to be 3.37×10^{18} n/cm^2 (E > 1 MeV) for the lower intermediate shell axial welds at the RV inner surface. The staff concluded that the TLAAs had therefore been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The applicant, as part of its resolution of OI 4.2, added Commitment 48 to confirm, by June 8, 2010, that the limiting fluence will not be reached during the period of extended operation.

The staff finds the TLAA for the RV material USE acceptable in accordance with 10 CFR 54.21(c)(1)(ii). As reported in Section 4.2, the staff has reviewed and accepted Commitment 48 and the alternative fluence analysis for resolving OI 4.2 and confirming the results of the TLAAs. Commitment 48 is hereby superseded by License Condition 4.2.6 addressed in SER Section 4.2.6. The staff, therefore, concludes that OI 4.2 is closed.

4.2.3.3 UFSAR Supplement

The applicant provided in LRA Section A.2.2.1.3. an UFSAR supplement summary description of its TLAA evaluation of RV P-T limits. The staff could not complete the review of LRA Section 4.2.3 and, therefore, could not complete the review of LRA Section A.2.2.1.3. This item was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant's revised LRA Section A.2.2.1.2 to include the following UFSAR supplement summary description for the TLAA of the RV materials USE:

> Appendix G of 10 CFR 50 requires that reactor vessel beltline materials "have Charpy upper-shelf energy ... of no less than 75 ft-lb initially and must maintain Charpy upper-shelf energy throughout the life of the vessel of no less than 50 ft-lb...." The initial (unirradiated) values of the Charpy USE for the PNPS beltline welds were provided to the NRC in correspondence responding to Generic Letter 92-01.
>
> RG 1.99, Revision 2 provides two methods for determining USE. Position 1 applies for material that does not have surveillance data and Position 2 applies for material with surveillance data. Position 2 requires a minimum of two sets of credible material surveillance data. Since PNPS has data from only one RV material

surveillance capsule, Position 2 does not apply. For Position 1, the percent drop in USE for a stated copper content and neutron fluence is determined by reference to *Figure 2 of RG 1.99, Revision 2. This percentage drop is applied to the initial USE* to obtain the adjusted USE.

The predictions for percent drop in USE at 54 EFPY must be based on chemistry data, the maximum 1/4T fluence values, and unirradiated USE data submitted to the NRC in the applicant's response to GL 92-01. The predicted USE values for 54 EFPY will utilize Position 1 from RG 1.99, Revision 2. The predictions will use RG 1.99, Revision 2, Position 1, Figure 2; specifically, the formula for the lines will be used to calculate the percent drop in USE.

PNPS will use chemistry data from previous licensing submittals, the PNPS response to GL 92-01, and the 1/4 fluence values to be determined to perform linear interpolation on the USE percent drop values in RG 1.99, Revision 2, Figure 2.

The license renewal SER for BWRVIP-74, Action Item #10, states that each license renewal applicant shall demonstrate that the percent reduction in USE values for their beltline materials is less than that specified for the limiting BWR/3-6 plates and the non-Linde 80 submerged arc welds given in BWRVIP-74. This action item is not applicable to PNPS if the PNPS projected USE values remain above the 50 ft-lb limit through the end of the period of extended operation.

The alternative limiting fluence analysis determined that the limiting fluence value for all fluence-dependent TLAAs is the fluence that results in the maximum allowable mean RT_{NDT} for the TLAA of the axial weld failure probability, based on the March 7, 2000 BWRVIP-05 supplemental SER. The corresponding maximum allowable fluence for this TLAA is 3.37×10^{18} n/cm^2. This fluence is the limiting fluence value identified.

If the fluence remains below this limiting value during the period of extended operation, the fluence will yield acceptable results for the USE TLAA. To confirm that this TLAA will be valid to the end of the period of extended operation, Entergy will submit to the NRC on or before June 8, 2010 calculations consistent with Regulatory Guide 1.190 that will demonstrate limiting fluence values will not be reached during the period of extended operation.

The applicant's revised UFSAR supplement summary description for the TLAA of the RV materials USE appropriately describes how the applicant applied the alternative limiting fluence analysis described in SER Section 4.2 to close out this TLAA. The applicant's UFSAR supplement summary description is consistent with the staff analysis for the TLAA of the RV materials USE in SER Section 4.2.3.2. Based on this assessment, the staff finds the UFSAR supplement summary description for the TLAA of the RV materials USE acceptable. The staff concludes that OI 4.2 is closed.

4.2.3.4 Conclusion

The staff has reviewed the applicant's TLAA of the RV materials USE, as summarized in revised

LRA Section 4.2.3, and has determined that the RV materials USE TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). License Condition 4.2.6 has been imposed to confirm the results of the applicant's calculation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA for the RV materials USE for the period of extended operation, as required by 10 CFR 54.21(d).

4.2.4 Adjusted Reference Temperature

4.2.4.1 Summary of Technical Information in the Application

LRA Section 4.2.4 summarizes the ART evaluation for the period of extended operation. Irradiation by high-energy neutrons raises the RV RT_{NDT} value as defined in ASME Code, Section NB-2320. The initial RT_{NDT} is determined 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. The ART is defined as initial RT_{NDT} + ΔRT_{NDT} + margin. The margin is defined in RG 1.99, Revision 2. The P-T curves are developed from the ART value for the vessel materials. RG 1.99, Revision 2, defines the calculation methods for RT_{NDT} and ART. The RV was evaluated for an assumed exposure of less than 10^{19} nvt of neutrons with energies exceeding 1 MeV. After approximately 4.17 EFPY, the first surveillance capsule was withdrawn from the vessel and tested. The capsule test report concludes that the shift in RT_{NDT} and USE over 32 EFPY will be within 10 CFR Part 50 guidelines.

The applicant projected ΔRT_{NDT} and ART values at 54 EFPY using the methodology of RG 1.99 and calculated them using the chemistry data, margin values, initial RT_{NDT} values, and CFs in response to GL 92-01. Initial RT_{NDT} values are from Safeguards Implementation Report (SIR)-00-082 submitted in 2001 as part of the P-T limit change request. The applicant calculated new fluence factors according to RG 1.99, Revision 2, Equation 2, and new ΔRT_{NDT} values by multiplying the chemistry and fluence factors for each plate and weld, then added calculated margins and the initial RT_{NDT} to the calculated ΔRT_{NDT} to arrive at the new ART value.

4.2.4.2 Staff Evaluation

In reviewing the initial RT_{NDT} data, chemistry data (%Cu and %Ni), and CF values for the RV beltline materials provided by the applicant in Table 4.2-2 of the original LRA, the staff found several discrepancies with corresponding data previously established in the staff's RV integrity database for these RV beltline materials. The staff noted that Lower Intermediate Shell Plates G-3108-1 and G-3108-3 have initial RT_{NDT} values less conservative than the corresponding initial RT_{NDT} values established in the RV integrity database for these beltline plates. The staff also noted that the %Cu and CF values for Lower Shell Axial Welds 2-338 A, B, and C from Table 4.2-2 are less conservative than the corresponding %Cu and CF values established in the RV integrity database for these beltline welds.

In RAI 4.2.4-1 dated September 8, 2006, the staff asked the applicant to reconcile these discrepancies.

In its response dated October 6, 2006, the applicant justified the use of both the initial RT_{NDT} values and %Cu values listed in Table 4.2-2 of the original LRA by Structural Integrity Associates

Technical Report SIR-00-082, "Updated Evaluation of Reactor Pressure Vessel Material Properties for PNPS Nuclear Power Station," which was included as part of a January 30, 2001, RAI response during proceedings on a request to amend the technical specifications P-T limits. This technical report was evaluated and found acceptable by the staff as part of the review for the current technical specifications P-T limits.

Based on its review, the staff found that all material chemistry and initial RT_{NDT} data from Table 4.2-2 of the original LRA were acceptable for evaluating this and related TLAAs. The staff's concern described in RAI 4.2.4-1 is resolved.

However, during the continued review of original LRA Section 4.2.4 to evaluate the acceptability of the applicant's analysis pursuant to 10 CFR 54.21(c)(1) the staff concluded that, due to the lack of benchmarking data in support of the plant-specific RAMA fluence calculations, it was unable to authorize the 54 EFPY fluence values for use in support of the TLAA for the ART. This was identified as OI 4.2 in the SER with OI issued in March 2007.

Using the material chemistry data and the initial RT_{NDT} values in Table 4.2-2 of the original LRA, the staff was able to confirm the applicant's back-calculation of the maximum allowable fluence value for the TLAAs of the ART and P-T limits based on the 212°F RCS hydrostatic/leak testing criterion. This back-calculation is reported in SER Section 4.2.

In its May 17, 2007 letter, the applicant provided an alternative limiting fluence analysis for closing out this TLAA. The staff reviewed and evaluated this analysis as reported in SER Section 4.2 and determined that it provides in revised LRA Section 4.2.4 an acceptable basis for closing out the TLAA for the RV materials ART. The limiting fluence value for all fluence-dependent TLAAs was determined to be 3.37×10^{18} n/cm^2 (E > 1.0 MeV) for the lower intermediate shell axial welds at the RV inner surface. The staff concluded that the TLAAs had therefore been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The applicant, as part of its resolution of OI 4.2, added Commitment 48 to confirm, by June 8, 2010, that the limiting fluence will not be reached during the period of extended operation.

The staff finds the TLAA for the RV materials ART acceptable in accordance with 10 CFR 54.21(c)(1)(ii). As reported in SER Section 4.2, the staff has reviewed and accepted Commitment 48 and the alternative fluence analysis for resolving OI 4.2 and confirming the results of the TLAAs. Commitment 48 is hereby superseded by License Condition 4.2.6 addressed in SER Section 4.2.6. The staff, therefore, concludes that OI 4.2 is closed.

4.2.4.3 UFSAR Supplement

The applicant provided in LRA Section A.2.2.1.4 an UFSAR supplement summary description of its TLAA evaluation of ART. As noted, the staff could not complete the review of LRA Section 4.2.4 and, therefore, could not complete the review of LRA Section A.2.2.1.4.This item was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant revised LRA Section A.2.2.1.4 to include the following UFSAR supplement summary description for the TLAA of RV materials ART:

Irradiation by high-energy neutrons raises the value of RT_{NDT} for the reactor vessel. RT_{NDT} is the reference temperature for nil-ductility transition as defined in Section NB-2320 of the ASME

Code. The initial RT_{NDT} is determined 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. The adjusted reference temperature (ART) is defined as initial RT_{NDT} + ΔRT_{NDT} + margin. The margin is defined in RG 1.99, Revision 2. The P-T limit curves are developed from the ART value for the RV materials. RG 1.99, Revision 2 defines the calculation methods for the ART.

The PNPS reactor vessel was evaluated for an assumed neutron fluence of less than 10^{19} n/cm^2, with energies exceeding 1 MeV. After approximately 4.17 EFPY, the first surveillance capsule was withdrawn from the vessel and tested. The capsule test report concludes that the shift in RT_{NDT} and upper-shelf energy over 32 EFPY will be within 10 CFR 50 guidelines.

PNPS will project values for ΔRT_{NDT} and ART at 54 EFPY using the methodology of RG 1.99, Rev 2. These values will be calculated using the chemistry data, margin values, initial RT_{NDT} values, and Chemistry Factors (CFs) contained in the PNPS response to GL 92-01. Initial RT_{NDT} values are from report SIR-00-082, which was submitted in 2001 as part of the PNPS P-T limit change request. New 1/4T fluence values will be used, as discussed in revised LRA Section 4.2.1. New fluence factors (FFs) will be calculated using the expression in RG 1.99, Revision 2, Equation 2, where the fluence factor is given by:

FF = f (0.28-0. 10*log(f))

In this equation, f is the 1/4T fluence value. The new ΔRT_{NDT} values will be calculated by multiplying the CF and the FF for each plate and weld. Calculated margins and the initial RT_{NDT} values will then be added to the calculated ΔRT_{NDT} in order to arrive at the new value of the ART.

The alternative limiting fluence analysis determined that the limiting fluence value for all fluence-dependent TLAAs is the fluence that results in the maximum allowable mean RT_{NDT} for the TLAA of the axial weld failure probability, based on the March 7, 2000 BWRVIP-05 supplemental SER. The corresponding maximum allowable fluence for this TLAA is 3.37 x 10^{18} n/cm^2. This fluence is the limiting fluence value identified.

If fluence remains below this limiting value during the period of extended operation, the fluence will yield acceptable results for the reactor vessel adjusted reference temperature TLAA. To confirm that this TLAA will be valid to the end of the period of extended operation, Entergy will submit to the NRC on or before June 8, 2010 calculations consistent with Regulatory Guide 1.190 that will demonstrate limiting fluence values will not be reached during the period of extended operation.

The applicant's revised UFSAR supplement summary description for the TLAA of the RV materials ART appropriately describes how the applicant applied the alternative limiting fluence analysis described in SER Section 4.2 to close out this TLAA. The applicant's UFSAR supplement summary description is consistent with the staff analysis for the TLAA of the RV materials ART in SER Section 4.2.4.2. Based on this assessment, the staff finds the UFSAR supplement summary description for the TLAA of the RV materials ART acceptable. The staff concludes that OI 4.2 is closed.

4.2.4.4 Conclusion

The staff has reviewed the applicant's TLAA of the RV materials ART, as summarized in revised LRA Section 4.2.4, and has determined that the RV materials ART TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). License Condition 4.2.6 has been imposed to confirm the results of the applicant's calculation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA for the RV materials ART for the period of extended operation, as required by 10 CFR 54.21(d).

4.2.5 Reactor Vessel Circumferential Weld Inspection Relief

4.2.5.1 Summary of Technical Information in the Application

LRA Section 4.2.5 summarizes the evaluation of RV circumferential weld inspection relief for the period of extended operation. Relief from GL 98-05 RV circumferential weld examination requirements is based on an analysis indicating acceptable probability of failure per reactor operating year based on RV metallurgical conditions as well as flaw size indications and frequencies of occurrence anticipated at the end of a licensed operating period. The applicant was granted this relief for the remainder of the original 40-year license term after an analysis satisfied the limiting conditional failure probability for the circumferential welds at the expiration of the current license based on BWRVIP-05 and the extent of neutron embrittlement. Analysis of the changes in metallurgical conditions anticipated over the period of extended operation is required to extend this relief.

The staff evaluation of BWRVIP-05 utilized the Fracture Analysis of Vessels-Oak Ridge (FAVOR) code for a probabilistic fracture mechanics analysis to estimate the RPV shell weld failure probabilities. Three key inputs to this analysis are (1) the estimated EOI mean neutron fluence, (2) mean chemistry values for vessel types, and (3) the assumption of potential for beyond-design-basis events. In LRA Table 4.2-3, the applicant compared the RV limiting circumferential weld parameters to those in the staff's analysis for the first two key assumptions.

The applicant's chemistry composition and CF values are the same as those in the staff's analysis; however, the 54 EFPY fluence value is lower than the corresponding 64 EFPY generic value. As a result, the ΔRT_{NDT} is lower than the 64 EFPY shift in the staff's analysis. In addition, the unirradiated reference temperature of the material is lower than the initial value assumed in the staff's analysis. The combination of a lower initial reference temperature and a lower shift (RT_{NDT} w/o margin) yields an ART considerably lower than the staff's mean analysis value. Although a conditional failure probability has not been calculated, the mean RT_{NDT} value at 54 EFPY is less than the 64 EFPY mean provided by the staff; therefore, the RPV conditional failure probability is less than that of the staff's analysis. As such, this TLAA has been projected to the end of the period of extended operation.

4.2.5.2 Staff Evaluation

The staff technical basis for relief from ASME Code, Section XI circumferential weld inservice inspection (ISI) requirements is addressed in the staff's final SER on the BWRVIP-05 report enclosed in a July 28, 1998, letter from Mr. G.C. Lanais, NRC, to Mr. C. Terry, the BWRVIP Chairman. In this letter, the staff concluded that because the failure frequency for circumferential welds in BWR plants is significantly below the criterion specified in RG 1.154, "Format and Content of Plant-Specific Pressurized Thermal Shock Safety Analysis Reports for Pressurized Water Reactors," and below the core damage frequency of any BWR plant, continued inspection would result in a negligible decrease in an already acceptably low RV failure probability and justify elimination of the ISI requirements for RV circumferential welds. The staff's letter indicated that BWR applicants may request relief from ASME Code Section XI requirements for volumetric examination of circumferential RV welds by demonstrating that (1) at the expiration of the license the circumferential welds will satisfy the staff's July 28, 1998, evaluation of the limiting conditional failure probability for circumferential welds and (2) the applicants have implemented operator training and established procedures that limit the cold over-pressure event frequency to that specified in the staff's SER. The letter indicated that the requirements for inspection of RV circumferential welds during an additional 20-year license renewal period would need plant-specific reassessment as part of any BWR LRA. The applicant also must request relief from the ASME Code Section XI requirements for volumetric examination of circumferential welds for the extended license term in accordance with 10 CFR 50.55a(g).

In RAI 4.2.5-2 dated September 8, 2006, the staff asked the applicant whether it intended to apply for relief from the ASME Code RV circumferential weld examination requirements for the extended licensed period of operation.

In its response dated October 6, 2006, the applicant stated in accordance with 10 CFR 50.55a(g)5(iv), it will submit this request for each ASME Section XI Inservice Inspection ten-year interval within 12 months after the completion of the prior interval.

Based on its review, the staff finds the applicant's response to RAI 4.2.5-2 acceptable. The staff's concern described in RAI 4.2.5-2 is resolved.

Section A.4.5 of the BWRVIP-74 Report indicates that the staff's SER of the BWRVIP-05 report conservatively evaluated the BWR RVs to 64 EFPY, 10 EFPY greater than realistically expected for the end of the license renewal period. In its SER on the BWRVIP-05 Report dated July 28, 1998, the staff used the mean RT_{NDT} value to evaluate the failure probability of BWR circumferential welds at 32 and 64 EFPY. The neutron fluence in this evaluation was that at the RV inner diameter clad-weld interface.

As reported in SER Section 4.2, the staff found that the applicant correctly applied the 64 EFPY mean RT_{NDT} value of 128.5 °F from Table 2.6-5 of the staff SER on the BWRVIP-05 Report in the back-calculation of the maximum allowable 54 EFPY fluence for this TLAA. The staff used this mean RT_{NDT} value in its evaluation of the BWRVIP-05 Report for determining an acceptable circumferential weld conditional failure probability. The 128.5 °F 64 EFPY mean RT_{NDT} value from the staff SER on the BWRVIP-05 Report is characteristic of welds by Combustion Engineering, which fabricated the circumferential welds in the RV.

In the July 28, 1998, SER on BWRVIP-05, the staff concluded that examination of the RV circumferential shell welds would be necessary if the corresponding volumetric examinations of the RV axial shell welds revealed the presence of an age-related degradation mechanism.

In RAI 4.2.5-3 dated September 8, 2006, the staff asked the applicant to confirm whether previous volumetric examinations of the RV axial shell welds showed any indication of cracking or other age-related degradation mechanisms.
In its response dated October 6, 2006, the applicant stated that previous examinations of the RV axial shell welds had detected no relevant indications or other age-related degradation mechanisms in the welds.

Based on its review, the staff finds the applicant's response to RAI 4.2.5-3 acceptable. The staff's concern described in RAI 4.2.5-3 is resolved.

The original LRA stated that the procedures and training to limit cold over-pressure events will be the same as those approved by the staff when PNPS requested relief from RV circumferential weld examination requirements for the current license period in accordance with BWRVIP-05.

However, during the continued review of original LRA Section 4.2.5 to evaluate the acceptability of the applicant's analysis pursuant to 10 CFR 54.21(c)(1), the staff concluded that due to the lack of benchmarking data in support of the plant-specific RAMA fluence calculations, it was unable to authorize the 54 EFPY fluence values for use in support of the TLAA for the RV circumferential weld inspection relief. This was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant provided an alternative limiting fluence analysis for closing out this TLAA. The staff reviewed and evaluated this analysis as reported in SER Section 4.2 and determined that it provides in revised LRA Section 4.2.5 an acceptable basis for closing out the TLAA for the RV circumferential weld examination relief. The applicant determined the limiting fluence value for all fluence-dependent TLAAs to be 3.37×10^{18} n/cm^2 (E > 1.0 MeV) for the lower intermediate shell axial welds at the RV inner surface. The staff concluded that the TLAAs had therefore been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The applicant, as part of its resolution of OI 4.2, added Commitment 48 to confirm, by June 8, 2010, that the limiting fluence will not be reached during the period of extended operation.

The staff finds the TLAA for the RV circumferential weld examination relief acceptable in accordance with 10 CFR 54.21(c)(1)(ii). As reported in SER Section 4.2, the staff has reviewed and accepted Commitment 48 and the alternative fluence analysis for resolving OI 4.2 and confirming the results of the TLAAs. Commitment 48 is hereby superseded by License Condition 4.2.6 addressed in SER Section 4.2.6. The staff, therefore, concludes that OI 4.2 is closed.

4.2.5.3 UFSAR Supplement

The applicant provided in LRA Section A.2.2.1.5 an UFSAR supplement summary description of its TLAA evaluation of the RV circumferential weld inspection relief. As noted, the staff could not complete the review of LRA Section 4.2.5 and, therefore, could not complete the review of LRA Section A.2.2.1.5. This item was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant revised LRA Section A.2.2.1.5 to include the following UFSAR Supplement summary description for the TLAA of RV circumferential weld examination relief:

> Relief from reactor vessel circumferential weld examination requirements under Generic Letter 98-05 is based on an analysis indicating acceptable probability of failure per reactor operating year. The analysis is based on reactor vessel metallurgical conditions as well as flaw indication sizes and frequencies of occurrence that are expected at the end of a licensed operating period.
>
> PNPS received NRC approval for this relief for the remainder of the original 40-year license term. The basis for this relief request is an analysis that satisfied the limiting conditional failure probability for the circumferential welds at the expiration of the current license, based on BWRVIP-05 and the extent of neutron embrittlement. The anticipated changes in metallurgical conditions expected over the period of extended operation require additional analysis to extend this relief request.
>
> The NRC evaluation of BWRVIP-05 utilized the FAVOR code to perform a probabilistic fracture mechanics (PFM) analysis to estimate the reactor pressure vessel (RPV) shell weld failure probabilities. Three key inputs to the PFM analysis are (1) the estimated end-of-life mean neutron fluence, (2) mean chemistry values based on vessel types, and (3) the assumption of potential for beyond-design-basis events.
>
> PNPS will compare the reactor vessel limiting circumferential weld parameters to those used in the NRC analysis for the first two key assumptions. The data will be from the NRC SER for PNPS Relief Request 28, and from the data in Table 2.6.4 of the NRC SER for BWRVIP-05. (For comparison, the EOL mean RT_{NDT} will be calculated without margin and hence will be lower than the Section 4.2.2 RT_{NDT} value.)
>
> The procedures and training used to limit cold over-pressure events will be the same as those approved by the NRC when PNPS requested approval of the BWRVIP-05 technical alternative for the current license term.
>
> An analysis determined that the limiting fluence value is set by the maximum mean RT_{NDT} value for the vessel axial welds of 114 °F to remain below a calculated reactor vessel failure frequency of 5×10^{-6} per reactor year. The corresponding maximum allowable ID fluence for the axial welds was determined to be 3.37×10^{18} n/cm^2. This fluence is the limiting fluence value identified.
>
> If fluence remains below this limiting value during the period of extended operation, the fluence will yield acceptable results for the reactor vessel circumferential weld failure probability TLAA. To confirm that this TLAA will be valid to the end of the period of extended operation, Entergy will submit to the NRC on or before June 8, 2010 calculations consistent with Regulatory Guide 1.190 that will demonstrate limiting fluence values will not be reached during the period of extended operation.

The applicant's revised UFSAR Supplement summary description for the TLAA of the RV circumferential weld examination relief appropriately describes how the applicant applied the alternative limiting fluence analysis described in SER Section 4.2 to close out this TLAA. The applicant's UFSAR Supplement summary description is consistent with the staff analysis for the TLAA of the RV circumferential weld examination relief in SER Section 4.2.5.2. Based on this assessment, the staff finds the UFSAR Supplement summary description for the TLAA of the RV circumferential weld examination relief acceptable. The staff concludes that OI 4.2 is closed.

4.2.5.4 Conclusion

The staff has reviewed the applicant's TLAA of the RV materials circumferential weld examination relief, as summarized in revised LRA Section 4.2.5, and has determined that the RV circumferential weld examination relief TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). License Condition 4.2.6 has been imposed to confirm the results of the applicant's calculation. The staff also concludes that the UFSAR Supplement contains an appropriate summary description of the TLAA for the RV circumferential weld examination relief for the period of extended operation, as required by 10 CFR 54.21(d).

4.2.6 Reactor Vessel Axial Weld Failure Probability

4.2.6.1 Summary of Technical Information in the Application

The BWRVIP recommendations for inspection of RV shell welds (BWRVIP-05) are based on generic analyses supporting an SER conclusion that the generic-plant axial weld failure rate is no more than $5x10^{-6}$ per reactor year. BWRVIP-05 showed that this axial weld failure rate is orders of magnitude greater than the 40-year EOL circumferential weld failure probability and used this showing to justify relief from inspection of the circumferential welds as described.

The applicant was granted relief from the circumferential weld inspection requirements for the remainder of the original 40-year period of operation after a plant-specific analysis showed that the limiting conditional failure probability for the circumferential welds at the end of the original period of operation was less than the value calculated in the BWRVIP-05 SER. The BWRVIP-05 supplemental SER concluded that the RV failure frequency due to failure of the limiting axial welds in the BWR fleet at the end of 40 years of operation is less than $5x10^{-6}$ per reactor year. This failure frequency depends upon assumptions of flaw density, distribution, and location and also assumes that "essentially 100 percent" of the RV axial welds will be inspected. The applicant will require an additional relief request if it achieves less than 90 percent inspection coverage. The applicant will compare the RV limiting axial weld parameters to those in the staff analysis. The parameters will be those from the BWRVIP-05 supplemental SER.

Licence Renewal Applicant Action Item 12 from the BWRVIP-74 SER specifies that license renewal applicants should monitor RV beltline axial weld embrittlement. One acceptable method is to determine that the mean RT_{NDT} value of the limiting axial weld at the end of the period of extended operation is less than the values specified in Table 3 of the BWRVIP-05 supplemental SER, which also required comparison of the limiting axial weld to Table 3 data. For PNPS, the BWRVIP-05 supplemental SER determined that a limiting axial weld mean RT_{NDT} value of 114 °F would result in an acceptable axial weld failure frequency of 5×10^{-6} per reactor operating year.

The alternative limiting fluence analysis determined that a fluence value of 3.37 x 10^{18} n/cm^2 (E > 1.0 MeV) for the limiting axial welds at the RV inner surface would yield a mean RT_{NDT} value of 114 °F for the limiting axial welds. This fluence is the limiting fluence value set for the RV TLAAs.

If it remains below this limiting value during the period of extended operation, the fluence will yield acceptable results for the RV axial weld failure probability TLAA. To confirm that the limiting fluence will not be reached and consequently that this TLAA will be valid to the end of the period of extended operation Commitment 48 is added.

4.2.6.2 Staff Evaluation

In its July 28, 1998, letter to Mr. C. Terry, the BWRVIP Chairman, the staff stated a concern about the failure frequency of axial welds in BWR RVs. In response to this concern, the BWRVIP supplied evaluations of axial weld failure frequency in letters dated December 15, 1998, and November 12, 1999. The staff's BWRVIP-05 supplemental SER on these evaluations was enclosed in a March 7, 2000, letter from Mr. J. Strosnider (NRC) to Mr. C. Terry (BWRVIP). The staff's generic analysis used PNPS as a model for BWR RVs fabricated with electroslag welds and demonstrated that a mean RT_{NDT} value of 114 °F resulted in a failure frequency of 5 x 10^{-6} per reactor year of operation. This is the maximum allowable axial weld mean RT_{NDT} value resulting in an acceptable axial weld failure probability. assuming that the applicant would apply for circumferential weld examination relief for the period of extended operation. As reported in SER Section 4.2, the applicant correctly used this mean RT_{NDT} value for back-calculating the maximum allowable 54 EFPY fluence for this TLAA.

The limiting axial weld failure probability calculated by the staff in the BWRVIP-05 SER Supplement is based on the assumption that "essentially 100 percent" inspection coverage of all RV axial welds can be achieved in accordance with ASME Code, Section XI requirements.

In RAI 4.2.6-1 dated September 8, 2006, the staff asked the applicant to indicate whether ISI examinations achieve "essentially 100 percent" overall examination coverage for the RV axial welds for the duration of the current licensed operating period.
In its response dated October 6, 2006, the applicant stated that, due to various obstructions within the RV, it had not been able to inspect "essentially percent" of the RV beltline axial welds. The applicant operates under ISI program relief that authorizes limited-scope examination coverage for specified RV axial welds. The limited-scope examinations achieved an overall coverage of 83 percent of the total axial weld length in the beltline region. The technical basis for granting this relief from the ASME Code, Section XI requirements mandating essentially 100 percent examination coverage of all axial welds is documented in the staff's March 26, 1996, SER.

The staff considered the impact of the reduced axial weld examination coverage on the alternative limiting fluence analysis described in SER Section 4.2. The staff determined that the difference between the greater than 90-percent examination coverage (lowest coverage that qualifies as essentially 100 percent) assumed in the calculation of the limiting axial weld failure probability and the actual overall examination coverage of 83 percent of the total axial weld length in the beltline region was not large enough to justify a change in the back-calculation of the maximum allowable 54 EFPY fluence value for this TLAA to account for this difference. Specifically, with the conservatism of the axial weld failure probability analysis from the BWRVIP-05 SER Supplement, a difference of only 7 percent examination coverage between the greater than 90-percent coverage and the actual 83-percent coverage would not increase the axial weld failure probability enough to justify a reduction of the maximum allowable mean RT_{NDT} value for the axial weld failure probability below the established value of 114 °F. The staff's concern described in RAI 4.2.6-1 is resolved.

The current relief for the limited-scope axial weld examination coverage does not authorize reduced examination coverage for affected RV axial welds beyond the end of the current ISI interval. The anticipated changes in metallurgical conditions expected over the period of extended operation require an additional analysis for 54 EFPY and staff approval to extend the RV axial weld inspection relief through the end of the period of extended operation interval by interval. The applicant must submit, interval by interval, either a request for an alternative to ASME Code, Section XI requirements pursuant to 10 CFR 50.55a(a)(3) or a request for relief from ASME Code, Section XI requirements pursuant to 10 CFR 50.55a(g)(6)(i) to address future axial weld examinations if less than "essentially 100 percent" coverage is, or will be, achieved.

During the continued review of original LRA Section 4.2.6 to evaluate the acceptability of the applicant's analysis pursuant to 10 CFR 54.21(c)(1), the staff concluded that due to the lack of benchmarking data in support of the plant-specific RAMA fluence calculations, it was unable to authorize the 54 EFPY fluence values for use in support of the TLAA for the reactor vessel axial weld failure probability. This was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant provided an alternative limiting fluence analysis for closing out this TLAA. The staff reviewed and evaluated this analysis as reported in SER Section 4.2 and determined that it projects the TLAA to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). As reported in SER Section 4.2, the alternative limiting fluence analysis determined that the limiting fluence value for all fluence-dependent TLAAs was established by the maximum allowable 54 EFPY fluence for the TLAA of the RV axial weld failure probability. Back-calculation of this fluence value was based on the following inputs: (1) a threshold axial weld mean RT_{NDT} value of 114 °F previously established in the March 7, 2000, BWRVIP-05 SER Supplement as the maximum Pilgrim mean RT_{NDT} value for an acceptable axial weld failure probability, assuming that LRA applicants would request circumferential weld examination relief for the period of extended operation and (2) axial weld material chemistry data previously established in Section 4.2 of the original Pilgrim LRA. Based on these inputs, the limiting fluence value for all fluence-dependent TLAAs was 3.37×10^{18} n/cm^2 (E > 1.0 MeV) for the lower intermediate shell axial welds at the RV inner surface. The staff concluded that the TLAAs had therefore been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The applicant, as part of its resolution of OI 4.2, added Commitment 48 to confirm, by June 8, 2010, that the limiting fluence will not be reached during the period of extended operation.

The staff finds the TLAA for the axial weld failure probability acceptable in accordance with 10 CFR 54.21(c)(1)(ii). As reported in SER Section 4.2, the staff has reviewed and accepted Commitment 48 and the alternative limiting fluence analysis for resolving OI 4.2 and confirming the results of the TLAAs. The staff determined that Commitment 48 should be superseded by License Condition 4.2.6, which reads as follows:

License Condition 4.2.6: On or before June 8, 2010, the applicant (Entergy) will submit to the NRC correctly benchmarked RV neutron fluence calculations, consistent with RG 1.190, that will confirm that the neutron fluence for the lower intermediate shell axial welds, at the inner surface of the RV, will not reach the limiting value of 3.37×10^{18} n/cm^2 (E > 1.0 MeV) by the end of the period of extended operation (54 EFPY).

This license condition is imposed in this SER section because it addresses the limiting fluence value of 3.37×10^{18} n/cm^2 (E > 1.0 MeV) established by this TLAA. SER Sections 4.2.1.2, 4.2.2.2, 4.2.3.2, 4.2.4.2, 4.2.5.2, and 4.7.1.2 refer to the license condition. With the imposition of License Condition 4.2.6, the staff concludes that OI 4.2 is closed.

4.2.6.3 UFSAR Supplement

The applicant provided in LRA Section A.2.2.1.6 an UFSAR Supplement summary description of its TLAA evaluation of the RV axial weld failure probability. As noted, the staff could not complete the review of LRA Section 4.2.6 and, therefore, could not complete the review of LRA Section A.2.2.1.6. This item was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant revised LRA Section A.2.2.1.6 to include the following UFSAR Supplement summary description for the TLAA of RV axial weld failure probability:

The BWRVIP recommendations for inspection of reactor vessel shell welds (BWRVIP-05) are based on generic analyses supporting an NRC SER conclusion that the generic-plant axial weld failure rate is no more than 5×10^{-6} per reactor year. BWRVIP-05 showed that this axial weld failure rate is orders of magnitude greater than the 40-year end-of-life circumferential weld failure probability, and used this analysis to justify relief from inspection of the circumferential welds as described above.

> PNPS received relief from the circumferential weld inspections for the remainder of the original 40-year operating term. The basis for this relief request was a plant-specific analysis that showed the limiting conditional failure probability for the PNPS circumferential welds at the end of the original operating term was less than the values calculated in the BWRVIP-05 SER. The BWRVIP-05 SER [Supplement] concluded that the reactor vessel failure frequency due to failure of the limiting axial welds in the BWR fleet at the end of 40-years of operation is less than 5×10^{-6} per reactor year. This failure frequency is dependent upon given assumptions of flaw density, distribution, and location. The failure frequency also assumes that "essentially 100%" of the reactor vessel axial welds will be inspected. The PNPS relief request requires additional [an] relief request if less than 90% coverage is achieved.
>
> Applicant Action Item 12 from the NRC SER for BWRVIP-74 specified that applicants should monitor axial beltline weld embrittlement. One acceptable method was to determine that the mean RT_{NDT} of the limiting axial beltline weld at the end of the period of extended operation is less than the values specified in Table 1 of the FSER for BWRVIP-74 [corresponding to Table 3 from the March 7, 2000 BWRVIP-05 SER Supplement]. The limiting mean RT_{NDT} value of 114 °F for the axial welds was determined to result in an axial weld failure frequency of less than [or equal to] 5×10^{-6} per reactor year.

An analysis determined that the ID fluence value that yields a mean RT_{NDT} value for the vessel axial welds of 114 °F is 3.37 x 10^{18} n/cm^2. This fluence is the limiting fluence value identified.

If fluence remains below this limiting value during the period of extended operation, the fluence will yield acceptable results for the reactor vessel axial weld failure probability TLAA. To confirm that this TLAA will be valid to the end of the period of extended operation, Entergy will submit to the NRC on or before June 8, 2010 calculations consistent with Regulatory Guide 1.190 that will demonstrate limiting fluence values will not be reached during the period of extended operation.

The applicant's revised UFSAR Supplement summary description for the TLAA of the RV axial weld failure probability appropriately describes how the applicant applied the alternative limiting fluence analysis described in SER Section 4.2 to close out this TLAA. The applicant's UFSAR Supplement summary description is consistent with the staff analysis for the TLAA of the RV axial weld failure probability in SER Section 4.2.6.2. Based on this assessment, the staff finds the UFSAR Supplement summary description for the TLAA of the RV axial weld failure probability acceptable. The staff concludes that OI 4.2 is closed.

4.2.6.4 Conclusion

The staff has reviewed the applicant's TLAA of the axial weld failure probability as summarized in revised LRA Section 4.2.6 and has determined that the axial weld failure probability TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). License Condition 4.2.6 has been imposed to confirm the results of the applicant's calculation. The staff also concludes that the UFSAR Supplement contains an appropriate summary description of the TLAA for the axial weld failure probability for the period of extended operation, as required by 10 CFR 54.21(d).

4.3 Metal Fatigue

Fatigue analyses are potential TLAAs for Class 1 and selected non-Class 1 mechanical components. Fatigue is an age-related degradation mechanism caused by cyclic stressing of a component by either mechanical or thermal stresses that become evident by cracking. Fatigue analyses are treated as TLAAs if the analyses are based on sets of design transients that are tracked and analyzed over the life for the plant.

Class 1 components (reactor vessel and recirculation system piping) are subject to an ASME Code, Section III, Subsection NB fatigue analysis. ASME Code, Section III requires evaluation of fatigue by consideration of design thermal and loading cycles. The applicant monitors transient cycles that contribute to fatigue usage in accordance with Technical Specification 5.5.5 requirements. Reactor coolant system (RCS) pressure boundary piping (with the exception of reactor recirculation piping) was designed to American National Standards Institute (ANSI) B31.1, and secondary stresses (*e.g.*, stresses due to thermal expansion and anchor movements) are analyzed for fatigue with stress intensification factors and stress range allowables, which are functions of thermal design cycles. Reviews of non-Class 1 aging management identify non-Class 1 mechanical components within the scope of license renewal and subject to aging management review. Specific components exposed to mechanical and thermal cycling are subject to cracking by fatigue.

Fatigue evaluations that meet the TLAA definition for Class 1 and non-Class 1 mechanical components are described and evaluated below. Cumulative usage factors (CUFs) have been documented and the actual numbers of design transient cycles have been projected to 60 years. Although some transients are projected to exceed the cycle limits before the end of 60 years, a program is in place to track cycles and to take corrective actions if limits are approached. In addition to metal fatigue analyses, fracture mechanics analyses of flaw indications detected by ISI are TLAAs for those analyses based on time-limited assumptions defined by the current operating term. When a flaw is detected during ISIs, the component can be evaluated for continued service in accordance with ASME Code, Section XI. The evaluation may find the component acceptable at the end of the current operating term based on predicted inservice flaw growth typically due to design thermal and loading cycles.

4.3.1 Class 1 Fatigue

Class 1 components evaluated for fatigue and flaw growth include the RPV and appurtenances, certain reactor vessel internals, the reactor recirculation system (RRS), and the RCS pressure boundary. Class 1 systems include components within the ASME Code, Section XI, Subsection IWB inspection boundary. Fatigue evaluations in the design of the Class 1 components in accordance with ASME Code, Section III specified requirements in analyses and stress reports are considered TLAAs because they are based on a number of transient cycles assumed for a 40-year plant life. Further, design cyclic loadings and thermal conditions for the Class 1 components are defined by applicable design specifications for each component. The original design specifications provided the initial sets of transients for component design and are included in each component analysis or stress report. The component analyses and stress reports include the fatigue evaluations for each component.

LRA Table 4.3-1 shows the 40-year CUFs for the RPV and its appurtenances, the RPV internals, and the Class 1 piping commodity groups. LRA Table 4.3-2 shows the design basis operational and transient categories that form the basis of the applicant's 40-year CUF value calculations and includes the design basis upper limits for these transient categories and the applicant's projections of the number of cycles for these transients through the period of extended operation.

4.3.1.1 Summary of Technical Information in the Application

4.3.1.1.1 Reactor Vessel

LRA Section 4.3.1.1 summarizes the evaluation of reactor vessel fatigue for the period of extended operation. The RPV and the RRS piping were designed in accordance with ASME Code, Section III.

The Fatigue Monitoring Program assures that the allowed number of transient cycles is not exceeded. The program requires corrective action if transient cycle limits are approached so the effects of aging on intended function(s) will be adequately managed for the period of extended operation.

4.3.1.1.2 Reactor Vessel Internals

LRA Section 4.3.1.2 summarizes the evaluation of reactor vessel internals fatigue for the period of extended operation. Although not mandated, the design of the reactor vessel internals is in accordance with the intent of ASME Code, Section III. However, the design basis document reveals that the core shroud stabilizer (tie rods) is the only internals component for which there is a fatigue analysis, the result of a repair to structurally replace circumferential shroud welds surrounding the core. This analysis is a TLAA. The maximum CUF for the shroud for 40 years of operation is 0.33. The Fatigue Monitoring Program validates the fatigue analyses by monitoring the actual numbers of cycles and evaluating them against the design values for numbers of allowable cycles. Fatigue analyses for the core shroud stabilizer will remain valid or aging effects on the intended function(s) will be adequately managed for the period of extended operation.

4.3.1.1.3 Class 1 Piping and Components

LRA Section 4.3.1.3 summarizes the evaluation of Class 1 piping and component fatigue for the period of extended operation. All RRS piping originally designed to ANSI B31.1, 1967 Edition, including connecting portions of core spray, reactor water cleanup, and residual heat removal system piping, has been replaced in response to GL 88-01 and in accordance with NUREG-0313. Fatigue evaluations ensured that the cyclic load combinations for service levels A and B do not exceed code allowables and that CUFs do not exceed 1.0 in accordance with ASME Code, Section III, Subsection NB. All remaining RCS pressure boundary piping is designed and analyzed in accordance with ANSI B31.1.

The recirculation system loop A and loop B piping analyses were the fatigue design basis and the source documents for the Class 1 piping CUFs. Current design basis fatigue evaluations are based on design transients tracked and evaluated so cycle limits are not exceeded and CUFs do not exceed 1.0. Corrective actions are taken if limits are approached. Continuation of the Fatigue Monitoring Program, therefore, ensures that the allowed number of transient cycles is not exceeded. Consequently, the TLAA for Class 1 piping and components will remain valid or the aging effects on the intended function(s) will be adequately managed for the period of extended operation.

4.3.1.1.4 Feedwater Nozzle Fatigue

LRA Section 4.3.1.4 summarizes the evaluation of feedwater nozzle fatigue for the period of extended operation. The 0.637 CUF is calculated from the number of design transients consistent with those of other Class 1 components. The < 0.8 CUF is based on the system design transients plus rapid thermal cycling of the feedwater nozzle due to leakage past the thermal sleeve. The nozzles were installed seven years into the 40-year life of the plant. The rapid cycling usage factor of < 0.8 is based on the system transient CUF plus the thermal cycling from 33 years of operation worth an additional 0.163 CUF. The period of extended operation will add 20 years to the service life of the nozzles and approximately 0.099 to the CUF. The extrapolated usage factor for the feedwater nozzles, considering both the currently analyzed system design transients and rapid cycling through the period of extended operation, is thus < 0.899. Thus the main feedwater CUF including rapid thermal cycling has been projected for the period of extended operation.

The Fatigue Monitoring Program will ensure that the allowed number of transient cycles is not exceeded by requiring corrective action if transient cycle limits are approached. Consequently, the TLAA (fatigue analyses based on design transients) for the main feedwater nozzle will remain valid or aging effects on the intended function(s) will be adequately managed for the period of extended operation.

4.3.1.2 Staff Evaluation

ASME Boiler and Pressure Vessel Code, Section III, requires CUFs as the basis for performing the metal fatigue analyses for those Class 1 components that were designed to Section III. ASME Code, Section III sets an acceptance criterion of 1.0 on CUF values and requires additional corrective action if these calculated values are projected to exceed this value prior to the expiration of the operating license. SRP-LR Section 4.3 defines how the metal fatigue analyses for ASME Code, Section III components may be accepted in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii).

The ANSI B31.1 design code requires a different type of fatigue analysis for those Class 1 components that were designed to B31.1 requirements. ANSI B31.1 requires calculation of a maximum allowable stress range for each B31.1 component that is subject to thermal cycling and a determination of the number of full thermal cycles that are projected to the expiration of the operating license. ANSI B31.1 then establishes what reduction factors must be applied to the maximum allowable stress ranges if the number of thermal cycles are projected to exceed 7000. SRP-LR Section 4.3 defines how the metal fatigue analyses for ANSI B31.1 components may be accepted in accordance with 10 CFR 54.21(c)(1)(i), (ii), or (iii).

4.3.1.2.1 Reactor Vessel

The staff reviewed LRA Section 4.3.1.1 to verify pursuant to 10 CFR 54.21(c)(1)(i) that the analyses remain valid for the period of extended operation or 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 the following parts of the LRA as to the applicant's TLAA for Class 1 metal fatigue:

- LRA Section 4.3.1, "Class 1 Fatigue"
- LRA Table 4.3-1, "Maximum CUFs for Class 1 Components"
- LRA Table 4.3-2, "Projected Cycles"

The staff also reviewed LRPD-06, PNPS 40-year design basis CUF calculations, and a General Electric (GE) thermal power optimization report for PNPS to assess whether the documents provided an acceptable basis for the 40-year CUF values listed for the Class 1 components in LRA Table 4.3-1.

The scope of the 40-year CUF values in LRA Table 4.3-1 for Class 1 components include those for the RPV, RPV nozzle appurtenances, RPV closure flange components, core shroud tie rods, and RRS piping loops A and B.

The staff also reviewed the transients listed in LRA Table 4.3-2 to assess whether the total number of cycles projected at the expiration of the period of extended operation (*i.e.*, after 60 years of licensed operations) will exceed the maximum number of cycles allowed for the transients in the design basis. This review was to determine whether the applicant should have included updated 60-year CUF calculations for those Class 1 components evaluated in accordance with 40-year CUF calculations and, if not, whether cycle counting alone in accordance with the applicant's Fatigue Monitoring Program would be sufficient to manage fatigue-induced cracking without implementation of the CUF updates recommended in NUREG-1801, Revision 1, Volume 2, "Generic Aging Lessons Learned (GALL) Report," AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary."

The staff reviewed LRA Table 4.3-2 and the PNPS program evaluation report and determined that both documents projected the total number of cycles for more than half of the operational transients analyzed in LRA Table 4.3-2 to exceed the maximum number of cycles for these transients allowed by the current design basis. The applicant addressed this issue along with Commitment No. 35 in a letter dated September 13, 2006. As discussed in the following paragraphs, the staff evaluated whether the TLAA on Class 1 component metal fatigue, coupled to the activities proposed in Commitment No. 35, complies with 10 CFR 54.21(c)(1) requirements.

The applicant stated that all RPV components were designed to Section III.

In a letter dated July 5, 2006, the applicant stated that LRA Table 4.3-1 should include the 40-year CUF value for the RPV recirculation outlet nozzle and that this table would be amended accordingly to include it. In a letter dated September 13, 2006, the applicant amended LRA Table 4.3-1 to include the 40-year CUF value for the RPV recirculation outlet nozzle as 0.747.

The staff also reviewed LRA Section 4.3.1.4, "Feedwater Nozzle Fatigue," to verify (1) pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation, (2) pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation, or (3) 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.

LRA Section 4.3.1.4 that the RPV feedwater nozzle as the limiting Class 1 component for CUF. The applicant stated that it had projected the feedwater nozzle CUF for 60 years, considering both the currently analyzed system design transients and rapid cycling through the period of extended operation. The applicant projected the 60-year feedwater nozzle CUF to be less than 0.899. The staff independently calculated the 60-year feedwater nozzle CUF value to be 1.217 on the same operational data and assumptions. During the audit, the staff requested that the applicant clarify how it had calculated the 60-year RPV feedwater nozzle CUF value, particularly as LRA Table 4.3-2 indicates that the number of cycles projected at 60 years for more than half of the design basis transients has exceeded the design basis allowables for the thermal transients.

In its response dated September 13, 2006, the applicant stated that the 60-year extrapolation of the CUF value for the feedwater nozzles in LRA Section 4.3.1.4 is no longer valid and that this section is not required and can be deleted. The applicant stated that it would manage fatigue-induced damage of the RPV components, including the RPV feedwater nozzles, in accordance with the specific aging management details in LRA Commitment No. 35.

Commitment No. 35 will require the applicant to (1) update 60-year CUF calculations for the RVP components (including RPV feedwater nozzles and other RPV appurtenances), (2) manage the aging effect of fatigue-induced damage by an inspection-based program approved by the NRC, or (3) repair or replace the affected RPV location before a 1.0 CUF value is exceeded. The activities within the scope of Commitment No. 35 will ensure that the TLAA on metal fatigue of the

RPV components, including the feedwater nozzle, will be projected for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) or that effects of fatigue-induced damage will be managed by inspection and corrective action (*i.e.*, repair or replacement of the component) in accordance with 10 CFR 54.21(c)(1)(iii).

Based on this evaluation, the staff concludes that the applicant's TLAA on metal fatigue of the RPV components (including the feedwater nozzle), along with Commitment No. 35, is acceptable as in accordance with 10 CFR 54.21(c)(1)(ii) or (iii) because the applicant will either reanalyze the 60-year CUFs, inspect for fatigue-induced cracking, or repair or replace the components.

4.3.1.2.2 Reactor Vessel Internals

The staff reviewed LRA Section 4.3.1.2 to verify pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation or 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 applicant stated that the RPV internal components were designed to the intent of Section III and that the core shroud tie rods (*i.e.*, core shroud stabilizer repair assemblies) were the only RPV internals with a 40-year CUF calculation. The applicant listed the CUF value for the tie rods as 0.330 through 40 years of operation and stated that this value is valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The core shroud tie rod assemblies were installed to assume the structural loading for the core shroud shells in lieu of the structural welds in the shroud design. The staff also determined that the applicant had installed the core shroud tie rod assemblies as a core shroud design modification in 1995. The staff also determined that the stress analyses for the core shroud tie rod assemblies are in the following documents developed to support the modification:

- GE Report 25A5685, Revision 1, "Stress Report - Shroud Stabilizers Vessel," June 19, 1995
- GE Report GENE 771-79-1194, Revision 2, "Shroud Repair Hardware Stress Analysis," June 19, 1995

The stress analyses included a Section III CUF calculation for the core shroud tie rod assemblies. The staff reviewed the stress analyses and confirmed that they list the tie rod assembly CUF as 0.330 over a 40-year design life. The current operating license (Operating License No. DPR-35) is scheduled to expire on June 8, 2012. The period of extended operation would initiate on June 8, 2012 and to expire on June 8, 2032. Thus, the core shroud tie rod assemblies will have operated for fewer than 38 years at the expiration of the period of extended operation.

On this assessment, the staff concludes that it is valid to use the 40-year CUF value for the tie rod assemblies through the period of extended operation because the design life of the components since their installation in 1995 covers that period and that the CUF value for the core shroud tie rod assemblies is acceptable in accordance with 10 CFR 54.21(c)(1)(i).

4.3.1.2.3 Class 1 Piping and Components

The staff reviewed LRA Section 4.3.1.3 to verify pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation or 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 found that the replacement piping for RRS piping loops A and B, the only Class 1 piping designed to ASME Code, Section III requirements, had 40-year CUF calculations for the current operating license period. The applicant specified the limiting 40-year CUF value for the RRS piping Loops A and B as 0.110.

As for other CUF calculations, the acceptance criterion for the RRS loops A and B CUF calculation is a piping CUF value less than 1.0 at both the expiration of the current operating license period and the expiration of the period of extended operation. The period of extended operation adds 20 years of licensed operation to the original 40-year period and, thus, increases the licensed operating time by a factor of 1.5. The 40-year CUF value for RRS piping loops A and B has sufficient margin that, even with an additional safety factor of 5, the CUF value would not exceed 0.550. This margin is sufficient to account for the 20 years that the period of extended operation will add to the operating license period. As described in SER Section 3.0.3.2.9, the applicant's Fatigue Monitoring Program tracks the number of thermal transients applicable to the CUF assessment for RRS piping loops A and B and requires corrective action if the number of cycles for any of the thermal transients approaches design basis allowable limits.

The staff concludes that the CUF analysis for RRS piping loops A and B is sufficient for the additional 20 years of the period of extended operation and is acceptable for 10 CFR 54.21(c)(1)(ii) and/or that the Fatigue Monitoring Program is sufficient to manage the TLAA on metal fatigue of RRS piping loops A and B for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

In a letter dated September 13, 2006, the applicant amended LRA Section 4.3.1 to address metal fatigue analysis for Class 1 piping components designed to ANSI B31.1. The applicant clarified that the total number of full thermal cycle transients projected through 60 years of operation was fewer than 7,000 and that, based on this projection, the allowable stress range analyses for these components remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). For Class 1 piping components designed to ANSI B31.1, the design code's metal fatigue analysis requires reduction of the maximum allowable stress range for the components if the number of cycles for the full thermal transients imparted on the components is projected to be greater than 7,000. According to SRP-LR Section 4.3.3.1.2.1, the maximum allowable stress range analysis in the original design basis for the ANSI B31.1 piping is valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i) if the total number of cycles for the full thermal transients, as postulated for the piping through the expiration of the period of extended operation for the facility, is fewer than 7,000.

The staff reviewed the thermal transients defined and summarized in LRA Table 4.3-2 and confirmed that the total number of full thermal transients projected at the end of the period of extended operation (*i.e.*, through 60 years of licensed power operations) is fewer than 7,000.

Based on this review, the staff concludes that there is no need to reduce the maximum allowable stress range values for the Class 1 B31.1 piping components and that the maximum allowable stress calculations for these components will remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i) requirements and SRP-LR Section 4.3.3.1.2.1 acceptance guidelines.

4.3.1.2.4 Feedwater Nozzle Fatigue

The staff reviewed LRA Section 4.3.1.4 to verify (1) pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation, (2) pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation, or (3) 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.

As described in SER Section 4.3.1.2.1, on September 13, 2006, the applicant stated that it will manage fatigue-induced damage of RPV components, including the RPV feedwater nozzles, in accordance with the specific aging management details in LRA Commitment No. 35.

Commitment No. 35 will require the applicant to (1) update 60-year CUF calculations for the RVP components (including RPV feedwater nozzles and other RPV appurtenances), (2) manage the aging effect of fatigue-induced damage by an inspection-based program approved by the NRC, or (3) repair or replace the affected RPV location before a 1.0 CUF value is exceeded. The activities within the scope of Commitment No. 35 will ensure that the TLAA on metal fatigue of the RPV components, including the feedwater nozzle, will be projected for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) or that effects of fatigue-induced damage will be managed by inspection and corrective action (*i.e.*, repair or replacement of the component) in accordance with 10 CFR 54.21(c)(1)(iii).

On the basis of its review, the staff concludes that the applicant's TLAA on feedwater nozzle fatigue is acceptable in accordance with 10 CFR 54.21(c)(1)(ii) or (iii).

4.3.1.3 UFSAR Supplement

The applicant provided the UFSAR supplement summary description of its TLAA on Metal Fatigue of Class 1 components in LRA Section A.2.2.2.1, which states how the TLAA would manage them against fatigue-induced damage for the period of extended operation. Upon its initial review of LRA Section A.2.2.2.1, the staff determined that the summary description of the CUF-based fatigue analyses for those Class 1 components designed to Section III requirements is sufficient. However, during the audit and review, the staff noticed that the summary description for this TLAA did not reflect Commitment No. 35. The staff requested the applicant to incorporate this commitment in the LRA.

In a letter dated September 13, 2006, the applicant amended the LRA and enhanced the TLAA on Metal Fatigue of Class 1 Components to include Commitment No. 35. In a letter dated October 6, 2006, the applicant stated that LRA Section A.2.2.2.1, "Class 1 Metal Fatigue," had been revised to refer to Commitment No. 35. The staff has evaluated in SER

Sections 4.3.1.2.12.1, 4.3.1.2.2, and 4.3.1.2.3 the TLAA on Metal Fatigue of Class 1 components and concluded that the TLAA, considering Commitment No. 35 incorporated by reference, is acceptable in accordance with 10 CFR 54.21(c)(1)(i), (ii) or (iii). Therefore, the staff concludes that the UFSAR supplement summary description in LRA Section A.2.2.2.1 is acceptable.

Based on this review, the staff concludes that UFSAR supplement summary description in LRA Section A.2.2.2.1, as amended by the letter of October 6, 2006, complies with 10 CFR 54.21(d).

4.3.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that, pursuant to 10 CFR 54.21(c)(1)(i) the TLAA on metal fatigue the analyses remain valid for the period of extended operation or that, pursuant to 10 CFR 54.21(c)(1)(ii), the metal fatigue analyses for the Class 1 components will be either projected to the end of the period of extended operation or that, pursuant to 10 CFR 54.21(c)(1)(iii), the effect of fatigue-induced damage on the intended functions of components will be adequately managed for period of extended operation. The staff also concludes that the UFSAR supplement, with Commitment No. 35, is an appropriate summary description of the TLAA on Metal Fatigue of Class 1 Components for the period of extended operation, as required by 10 CFR 54.21(d).

4.3.2 Non-Class 1 Fatigue

4.3.2.1 Summary of Technical Information in the Application

LRA Section 4.3.2 summarizes the evaluation of non-Class 1 fatigue for the period of extended operation. The design of ASME Section III Code Classes 2 and 3 piping systems incorporates the code stress reduction factor for acceptability of piping design as to thermal stresses. The design of ANSI B31.1 Code components also incorporates stress reduction factors based upon an assumed number (7000) of thermal cycles, allowing a stress reduction factor of 1.0 in the stress analyses. The applicant evaluated the validity of this assumption for 60 years of plant operation. The results of this evaluation indicate the assumption of 7000 thermal cycles is valid and bounding; therefore, the pipe stress calculations are valid for the period of extended operation.

Some license renewal applicants have estimated that primary sampling system piping will have more than 7000 thermal cycles before the end of the period of extended operation. PNPS reactor coolant samples are taken every 96 hours during normal operation from the reactor water cleanup filter influent, where the water already has been cooled; thus, normal sampling causes no thermal cycles. Alternate samples may be taken directly from the RRS B discharge header via containment penetration X-41A; however, this procedure is infrequent and this piping, designed to ANSI B31.1, will not exceed 7000 cycles prior to 60 years of operation.

4.3.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.2 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 LRA Section 4.3.2, including LRA Table 4.3-2, "Project Cycles," as to the TLAA on metal fatigue for Non-Class 1 components. The staff also reviewed the program evaluation report, "Time-Limited Aging Analyses – Mechanical Fatigue," as to the applicant's metal fatigue methods for the Non-Class 1 (Safety Classes 2 and 3) components.

According to SRP-LR Section 4.3.3.1.2.1, the original maximum allowable stress range analysis in the original design basis for B31.1 piping is valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i) if the total number of cycles for the full thermal transients, as postulated for the piping through the expiration of the period of extended operation, is fewer than 7000. The staff reviewed the program evaluation report and confirmed that the projected number of cycles at 60 years for the full thermal transients will be fewer the 7000 for the Non-Class 1 piping components.

Based on this review, the staff concludes that there is no need to reduce the maximum allowable stress range values for Non-Class 1 piping components designed to ANSI B31.1 requirements and that the stress calculations for these components will remain valid for the period of extended operation in accordance with requirements of 10 CFR 54.21(c)(1)(i).

4.3.2.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of non-Class 1 fatigue in LRA Section A.2.2.2.2 stating how the number of full thermal transients is projected to remain below 7000 at the expiration of the period of extended operation and, therefore, acceptably describing the TLAA for metal fatigue for non-Class 1 components by showing how the maximum allowable stress range analysis for the components remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

In SER Sections 3.2.2.2.1, 3.3.2.2.1, and 3.4.2.2.1, the staff assessed and accepted the applicant's basis for managing fatigue-induced damage in those non-Class 1 components designed to codes other than ANSI B31.1 (non-B31.1 design codes). In particular, the staff assessed the basis in the applicant's response to the staff's question to clarify which components in the non-Class 1 aging management review tables were fabricated in accordance with ANSI B31.1 design requirements and which in were fabricated accordance with design codes that require no metal fatigue analyses.

Based on its review, the staff concludes that the summary description is acceptable for the following reasons: (1) the UFSAR supplement summary description in LRA Section A.2.2.2.2 of how the TLAA on metal fatigue of non-Class 1 components remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i) for non-Class 1 components designed to ANSI B31.1 requirements is acceptable and (2) the applicant no longer relies on this TLAA to manage fatigue-induced damage for non-Class 1 components designed to non-B31.1 design codes. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address non-Class 1 fatigue is adequate.

4.3.2.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that, for non-Class 1 fatigue, the analyses remain valid for the period of extended operation. The staff also concludes, as described in SER Section 3.1.2.2.1, that the applicant has proposed valid AMPs to manage "cracking-fatigue" in non-Class 1 components in which "cracking-fatigue" is an applicable aging effect requiring management and for which the design code of record is other than ANSI B31.1. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.3 Effects of Reactor Water Environment on Fatigue Life

4.3.3.1 Summary of Technical Information in the Application

LRA Section 4.3.3 summarizes the evaluation of effects of reactor water environments on fatigue life for the period of extended operation. NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," applies fatigue design curves that incorporate environmental effects on several plants and identified locations of interest for consideration of environmental effects. NUREG/CR-6260 Section 5.7 indicates for PNPS-vintage General Electric plants the following component locations as most sensitive to environmental effects. These locations and the associated calculations relate directly to PNPS:

- reactor vessel shell and lower head
- reactor vessel feedwater nozzles
- reactor recirculation system piping (including inlet and outlet nozzles)
- core spray line reactor vessel nozzle and associated piping
- residual heat removal return piping
- feedwater piping

The applicant evaluated the limiting locations (a total of nine components at these six locations) using the guidance in GALL AMP X.M1, " Metal Fatigue of the Reactor Coolant Pressure Boundary," and in SRP-LR Sections 4.3.1.2, 4.3.2.2, and 4.3.3.2, "Generic Safety Issue." Four of nine components reviewed have an environmentally-adjusted CUF greater than 1.0. The ASME Code does not require environmental adjustment to fatigue analyses.

The applicant stated that, considering environmental effects, prior to the period of extended operation for each location that may exceed a 1.0 CUF, the applicant will implement 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 reviewed and approved by the staff (*e.g.*, periodic non-destructive examination of the locations at intervals to be determined by a method acceptable to the staff), or (3) repair or replacement of the affected components.

The applicant stated that, should it opt to manage fatigue during the period of extended operation, the AMP will be submitted for NRC review and approval at least two years prior to entering the period of extended operation. The effects of thermal fatigue for the limiting locations indicated in NUREG-6260 have been evaluated.

4.3.3.2 Staff Evaluation

The staff reviewed LRA Section 4.3.3 to verify (1) pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation, (2) pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation, or (3) 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 4.3.3 against SRP-LR Section 4.3.3.2, "Generic Safety Issue". SRP-LR recommends that the license renewal applicant address GSI-190. To assess the impact of the reactor coolant environment on a sample of critical components, the SRP-LR states that the applicant has to address the recommendations as follows:

1. The critical components include, as a minimum, those selected in NUREG/CR-6260.
2. The sample of critical components has been evaluated by applying environmental correction factors to the existing ASME Code fatigue analyses.
3. Formulas for calculating the environmental life correction factors are those contained in NUREG/CR-6583 for carbon and low-alloy steels, and in NUREG/CR-5704 for austenitic stainless steels (SSs), or an approved technical equivalent.

In LRA Table 4.3-3, the applicant has evaluated the sample of critical components by applying environmental correction factors to the current design basis ASME Code fatigue analysis. The staff confirmed that the critical components include those selected in NUREG/CR-6260. The staff also confirmed that environmental life correction factors are calculated in accordance with those formulas contained in NUREG/CR-6583 for carbon and low-alloy steels, and in NUREG/CR-5704 for austenitic SSs. Therefore, the staff confirmed that PNPS has followed the staff's recommendations to assess the impact of the reactor coolant environment consistent with SRP-LR.

During the audit and review, the staff noted that the projected numbers of transient cycles exceeded the numbers of current design basis transient cycles and that the CUFs were not evaluated based on the numbers of projected cycles. The staff asked why the new CUFs had not been calculated based on the 60-year projected cycles. The applicant responded that PNPS had not intended to imply that the CUFs should be projected out to 60 years in accordance with 10 CFR 50.41(c)(1)(ii). The applicant stated that as long as the cycles are not exceeded, the CUFs do not need to be recalculated. The applicant also stated that the Fatigue Monitoring Program assures that the analyses will be revised to increase the allowable number of cycles before exceeding the number of design basis cycles. The applicant's approach to address this issue is in accordance with 10 CFR 54(c)(1)(iii).

During the audit and review, the staff asked the applicant to resolve three issues in LRA Section 4.3.3 and LRA Table 4.3-3 as follows:

Issue 1. The footnotes in LRA Table 4.3-3 state that generic values for these components were from NUREG/CR-6220. The staff asked the applicant whether this statement should refer to NUREG/CR-6260.

In response, the applicant stated that this reference was a typo that should be NUREG/CR-6260.

The staff finds the applicant's response acceptable as NUREG/CR-6260 is the correct reference. Issue 1 is resolved.

Issue 2. The staff informed the applicant that plant-specific Class 1 component locations selected for the environmentally-adjusted CUF analysis should be based on the corresponding specific plant vintage assessed in NUREG/CR-6260 and that the plant-specific locations for analysis therefore depend on the compliance of a plant's Class 1 RCPB configuration with that analyzed for the corresponding plant design in the topical report. The staff informed the applicant that it could not use the generic NUREG/CR-6260 environmentally-adjusted CUF values for environmentally-adjusted CUF analysis without justification that the plant-specific Class 1 RCPB locations analyzed were the same as those analyzed for the corresponding BWR-designed vintage plant in NUREG/CR-6260.

To resolve the issue, the staff asked the applicant to justify its use of the NUREG/CR-6260 generic environmentally-adjusted CUF values for the RR outlet nozzle, core spray nozzle safe end, and feedwater piping.

In its response dated July 19, 2006, the applicant stated that the environmentally-adjusted CUF values for these components were intended as typical values for predicting the effect of the reactor coolant environment on fatigue. The applicant agreed to supplement the LRA to remove the environmentally-adjusted CUF values for the RR outlet nozzle, core spray safe end, and feedwater piping from LRA Table 4.3-3 and to amend the LRA to provide additional environmentally-adjusted fatigue analyses for these components.

In its response dated September 13, 2006, the applicant indicated that it had determined that its design basis includes environmentally-adjusted CUF calculations for the RR outlet nozzle, the core spray nozzle safe-end, and feedwater piping, and submitted a revised table including normal CUF values for these components to the expiration of the current operating license period (i.e., at the end of 40 years), projected CUF values for these components at the expiration of the period of extended operation, and their projected environmentally-adjusted CUF values at the expiration of the period of extended operation. The table also includes the 60-year environmentally-adjusted CUF calculations for all other plant-specific Class 1 components previously analyzed in accordance with ASME Code, Section III CUF calculations. The applicant stated that all CUFs that exceed 1.0 must be recalculated prior to the period of extended operation. The applicant included Commitment No. 31 to address this issue. The staff's resolution of this issue is deferred to the staff's resolution of RAI 4.3.3-1 which is discussed and evaluated below.

Issue 3: The staff asked the applicant for more details on its corrective action implementation plan for locations projected to have 60-year environmentally adjusted CUF values above 1.0. Specifically, the staff asked the applicant to clarify how the fatigue analyses would be refined further by selection of Option 1 of the corrective action implementation plan. The staff also informed the applicant that it would need to make a commitment in the LRA if Option 2 of the plan, manage the effects of aging, was selected as the course of corrective action for fatigue-induced damage in the components.

In its response dated September 13, 2006, the applicant added Commitment No. 31, stating it would implement one of several options for the locations indicated in NUREG/CR-6260 for BWRs of the PNPS vintage.

In RAI 4.3.3-1 dated July 26, 2007, the staff requested that the applicant provide additional information on the option(s) that will be used for LRA Commitment No. 31 and describe the methodology that will be used for the chosen Commitment No. 31 option(s) in sufficient detail for staff review.

In its response dated July 30, 2007, the applicant clarified which option would be implemented to fulfill Commitment No. 31 and provided the methodology that would be used to implement the selected option. Commitment No. 31 was revised to state:

"At least 2 years prior to entering the period of extended operation, for the locations identified in NUREG/CR-6260 for BWRs of the PNPS vintage, PNPS will refine our current fatigue analyses to include the effects of reactor water environment and verify that the cumulative usage factors (CUFs) are less than 1. This includes applying the appropriate Fen [sic] factors to valid CUFs determined in accordance with one of the following:

1. For locations, including NUREG/CR-6260 locations, with existing fatigue analyses valid for the period of extended operation, use the existing CUF to determine the environmentally adjusted CUF.
2. More limiting PNPS-specific locations with a valid CUF may be added in addition to the NUREG/CR-6260 locations.
3. Representative CUF values from other plants, adjusted to or enveloping the PNPS plant specific external loads may be used if demonstrated applicable to PNPS.
4. An analysis using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case) may be performed to determine a valid CUF.

During the period of extended operation, PNPS may also use one of the following options for fatigue management if ongoing monitoring indicates a potential for a condition outside the analysis bounds noted above:

1. Update and/or refine the affected analyses described above.
2. Implement an inspection program that has been reviewed and approved by the NRC (e.g., periodic nondestructive examination of the affected locations at inspection intervals to be determined by a method acceptable to the NRC).
3. Repair or replace the affected locations before exceeding a CUF of 1.0."

In its response dated July 30, 2007, the applicant also provided its implementation detail for these 3 options as follows:

The processes that will be used to develop the calculations for Option (1) are established design and configuration management processes. These processes are governed by Entergy's 10 CFR 50 Appendix B Quality Assurance (QA) program and include design input verification and independent reviews ensuring that valid assumptions, transients, cycles, external loadings, analysis methods, and environmental fatigue life correction factors will be used in the refined or new fatigue analyses.

The analysis methods for determination of stresses and fatigue usage will be in accordance with an NRC endorsed Edition of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III Rules for Construction of Nuclear Power Plant Components Division 1 Subsection NB, Class 1 Components, Sub articles NB-3200 or NB-3600 as applicable to the specific component.

PNPS will utilize design transients from Design Specifications as well as design transient information from typical BWR-3 references to bound all operational transients. The numbers of cycles used for evaluation will be based on the design number of cycles and actual cycle counts projected out to the end of license renewal period (60 years).

Environmental effect on fatigue usage will be assessed using methodology consistent with the GALL Report, Rev. 1, that states, " The sample of critical components can be evaluated by applying environmental life correction factors to the existing ASME Code fatigue analyses. Formulae for calculating the environmental life correction factors are contained in NUREG/CR-6583 for carbon and low-alloy steels and in NUREG/CR-5704 for austenitic stainless steel.

If Option (2) of Commitment 31 becomes necessary, the inspection program submitted for approval by the NRC will be described in terms of the ten elements specified in Branch Technical Position RLSB-1 (NUREG-1800, Appendix A-1). Parameters monitored will be the presence and sizing of cracks. Frequency of inspection and acceptance criteria will be established such that detection of aging effects will occur before there is a loss of component intended function(s). The method of inspection will be a qualified volumetric technique based on plant specific and industry-wide operating experience.

If Option (3) becomes necessary, repair or replacement of the affected component(s) will be in accordance with established plant procedures governing repair and replacement activities. These established procedures are governed by Entergy's 10 CFR 50 Appendix B QA Program and meet the applicable repair and replacement requirements of the ASME Code Section XI.

In a letter dated August 28, 2007, the applicant amended the LRA with respect to its basis for its environmentally-assisted fatigue analysis. In this letter, the applicant clarified that Option 1 of Commitment No. 31 for refined CUF calculations is consistent with both the NRC's recommendations for the periodic CUF updates in the "monitoring and trending" (i.e., program element 4) of GALL AMP X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary," and and for "corrective actions" in GALL AMP X.M1. The applicant also clarified that Options 2 and 3 of Commitment No. 31 are considered to be corrective actions that are consistent with the corrective actions recommended in the "corrective action" (i.e., program element 7) of the same GALL AMP. Based on these clarifications, the applicant amended the LRA to bring Commitment No. 31 within the scope of the applicant's Fatigue Monitoring Program and to credit this AMP as the basis for accepting this TLAA in accordance with 10 CFR 54.21(c)(1)(iii). These changes are consistent with the NRC's recommendations in GALL AMP X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary," and are acceptable. The following paragraphs provide additional information on why the changes in LRA Amendment No. 20 are acceptable.

The "corrective actions" of GALL Chapter X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary," state that acceptable corrective actions include repair of the component, replacement of component, or a more rigorous analysis of the component to demonstrate that the design limit will not be exceeded during the period of extended operation. The staff reviewed the 3 options in Commitment No. 31, which were included in the application as possible corrective actions to address those limiting RCPB components with projected environmentally-assisted CUFs in excess of the environmentally-assisted fatigue analysis limit (i.e., 1.0).

The staff reviewed the applicant's implementation plan for using Option (1) of Commitment No. 31 (i.e., the option for implementation of refined environmentally-assisted CUF calculations), as provided in the applicant's letter of August 28, 2007, against the staff's recommendation in SRP-LR Section 4.3.3.2, "Generic Safety Issues." The staff determined the response to the RAI indicated that the refined environmentally-assisted fatigue calculations would be based on the recommendations for performing environmentally-assisted fatigue calculations in NUREG/CR-6583 for steel components and in NUREG/CR-5704 for SS components and that the methods for determination of stresses and fatigue usage factors would be in accordance with an NRC-endorsed edition of the ASME Code Section III, Division 1, Subsection NB, Subarticles NB-3200 or NB-3600, as applicable to the specific component. Based on this response, the staff determined that the implementation plan for using Option (1) of the commitment indicates that the applicant will be using NRC-approved methods for reanalysis and that the option is in conformance with the "corrective actions" recommendations in the both the SRP-LR and GALL AMP X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary." Based on this assessment, the staff concludes that Option 1 of Commitment No. 31 is an acceptable "corrective action" option for this TLAA.

In its response to RAI 4.3.3-1, the applicant stated that, if Option (2) of Commitment No. 31 is selected for corrective action, the inspection program for implementing the options would meet the following criteria: (1) the inspection program would be based on the 10 program elements for an AMP, as defined in NRC Branch Position RLSB-1, (2) the AMP would be submitted for NRC review and approval at least two years prior to entering the period of extended operation, and (3) the method of inspection will be based on a qualified volumetric examination technique. The ASME Code Section XI, Paragraph IWB-3740(a) states that "Appendix L provides procedures that may be used to assess the effects of thermal and mechanical fatigue concerns on component acceptability for continued service"; the ASME Code Section XI, Paragraph IWB-3740(b) states that "Appendix L provides procedures that may also be used when the calculated fatigue usage exceeds the fatigue usage limit defined in the original Construction Code." Paragraph L-3400 of the ASME Code Section XI, Appendix L states that surface examinations or volumetric examinations of reactor coolant pressure boundary components may be used to verify the acceptability of affected components for further service. Based on this response, the staff determined that the implementation plan for using Option (2) of the commitment conforms to the examination provisions stated in paragraph L-3400 of the ASME Code Section XI, Non-mandatory Appendix L and with "corrective actions" recommended in GALL AMP X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary." Based on this assessment, the staff concludes that Option (2) of Commitment No. 31 is an acceptable "corrective action" option for this TLAA.

In its response to RAI 4.3.3-1, the applicant stated that Option (3) for repair or replacement of the affected locations is a corrective action. The applicant also stated that, if this option is selected for corrective action, the repair or replacement activities would be in compliance with applicable provisions of the ASME Code Section XI. The staff determined that, since the implementation of repair and replacement activities will be based on applicable ASME Code Section XI requirements, Option (3) of Commitment No. 31 is consistent the "corrective actions" recommended in GALL AMP X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary." On this basis, the staff concludes that Option (3) of Commitment No. 31 is also an acceptable "corrective action" option for this TLAA.

Based on this assessment, the staff concludes that the corrective actions methods discussed in the applicant's response to RAI 4.3.3-1 and provided in Commitment No. 31 are acceptable because they will be implemented in accordance with NRC-approved methods. Based on this review, the staff concludes that TLAA on environmentally-assisted fatigue is acceptable in accordance with 10 CFR 54.21(c)(1)(iii) because the applicant has credited the Fatigue Monitoring Program to manage the effects of aging during the period of extended operation and because the applicant has amended the Fatigue Monitoring Program to include the options in Commitment No. 31 for corrective action, as discussed above. RAI 4.3.3-1 is resolved.

4.3.3.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of effects of reactor water environments on fatigue life in LRA Section A.2.2.2.3. The applicant stated that the effects of the reactor coolant environment on the metal fatigue analysis had been evaluated for the LRA but only for 40 years and not for the period of extended operation. As a result, the staff determined that the initial version of the UFSAR supplement summary description did not describe the TLAA on environmental fatigue adequately because LRA Section A.2.2.2.3 would need an update to refer to LRA Commitment No. 31, which the applicant relies on for acceptance of the TLAA on environmental fatigue.

In a letter dated September 13, 2006, the applicant amended the LRA and added Commitment No. 31 to address the need for updated, 60-year environmental CUF calculations for plant-specific Class 1 locations that correspond to those analyzed in NUREG-6260. However, the applicant did not revise the LRA Section A.2.2.2.3 summary description to refer to Commitment No. 31.

In a letter dated August 28, 2007, the applicant amended LRA Section A.2.2.2.3 to refer to Commitment No. 31. The staff reviewed the UFSAR supplement summary description in LRA Section A.2.2.2.3 as amended by this letter. On July 30, 2007, the applicant amended Commitment No. 31 as discussed in the response to RAI 4.3.3-1. The staff determined that the summary description of this TLAA was adequate because it complies with the recommended in the SRP-LR UFSAR supplement table and because it has been amended to refer to LRA Commitment No. 31.

Based on its review, the staff concludes that LRA Section A.2.2.2.3, as amended by the August 28, 2007, letter, complies with 10 CFR 54.21(d).

4.3.3.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(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 Analyses of Electrical Equipment

The 10 CFR 50.49 EQ program is a TLAA for purposes of license renewal. The TLAA of the EQ electrical components includes all long-lived, passive, and active electrical and I&C components that are important to safety and located in a harsh environment. The harsh environments of the plant are those areas subject to environmental effects by loss of coolant accidents or high-energy line breaks. EQ equipment comprises safety-related and Q-list equipment, nonsafety-related equipment the failure of which could prevent satisfactory accomplishment of any safety-related function, and necessary post-accident monitoring equipment.

As required by 10 CFR 54.21(c)(1), the applicant must provide a list of EQ TLAAs 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

LRA Section 4.4 summarizes the evaluation of EQ analyses of electrical equipment for the period of extended operation. The Environmental Qualification of Electric Components Program manages component thermal, radiant, and cyclical aging, as appropriate, through aging evaluations 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 must be refurbished or replaced or their qualification must be extended prior to the aging limits established in the evaluation. Aging evaluations that specify a qualification of at least 40 years for EQ components are TLAAs for license renewal. The Environmental Qualification of Electric Components Program maintains these EQ components in accordance with their qualification bases.

The existing program, established to meet 10 CFR 50.49 commitments consistently with GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components," considers operating experience to modify qualification bases and conclusions, including qualified life. Compliance with 10 CFR 50.49 reasonably assures performance of component intended function(s) during accident conditions after the effects of inservice aging. Consistent with staff guidance in Regulatory Issue Summary (RIS) 2003-09, no additional information is required to address Generic Safety Issue168, "EQ of Electrical Components." Review of the existing program and operating experience ensures continued implementation of the Environmental Qualification of Electrical Components Program to manage the aging effects so that in-scope EQ components will continue to perform intended function(s) for the period of extended operation.

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 the plant basis document provided to determine whether adequate information to meet the 10 CFR 54.21(c)(1) requirement. For the electrical equipment addressed in the basis document, the applicant uses 10 CFR 54.21(c)(1)(iii) in its TLAA evaluation to demonstrate that EQ equipment aging effects will be adequately managed during the period of extended operation. As described in SER Section 3.0.3.1.3, the staff reviewed the Environmental Qualification of Electric Components Program to determine whether it assures continued performance of electrical and instrumentation and controls component intended functions consistent with the CLB for the period of extended operation. The staff's evaluation of the component qualification focused on how the program manages the aging effects to meet 10 CFR 50.49 requirements.

The staff audited the information in LRA Section B.1.11 and the program bases documents. On the basis of its audit, the staff finds that the Environmental Qualification of Electrical Components Program, for which the applicant claimed consistency with GALL AMP X.E1, "Environment Qualification of Electrical Components," is consistent with the GALL Report EQ program. Therefore, the staff finds the program capable of managing the qualified life of components within the scope of license renewal. Continued implementation of the Environmental Qualification of Electric Components Program reasonably assures management of aging effects and continued performance of intended functions of components within the scope of the program for the period of extended operation.

4.4.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of environmental qualification analyses of electrical equipment in LRA Section A.2.2.3. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address environmental qualification analyses of electrical equipment is adequate.

4.4.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that, for EQ analyses 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

LRA Section 4.5 states that evaluation of concrete containment tendon prestress is not applicable because PNPS has no pre-stressed tendons in the containment building.

4.5.2 Staff Evaluation

The staff confirmed that the PNPS containment has no prestressed tendons. Therefore, the staff finds that this TLAA is not required.

4.5.3 UFSAR Supplement

The staff concludes that no UFSAR supplement is required because PNPS has no pre-stressed tendons in the containment building.

4.5.4 Conclusion

On the basis of its review, as discussed above, the staff concludes this TLAA is not required for PNPS.

4.6 Containment Liner Plate, Metal Containment, and Penetrations Fatigue Analysis

4.6.1 Fatigue of Primary Containment

4.6.1.1 Summary of Technical Information in the Application

LRA Section 4.6.1 summarizes the evaluation of primary containment fatigue for the period of extended operation as part of the Mark I Containment Long-Term Program by methods and assumptions consistent with NUREG-0661. The program evaluated the torus and attached piping systems for fatigue from mechanical loadings as well as thermal and anchor motions. This evaluation assumed the number of safety relief valve actuations, operating basis earthquakes, and accident conditions during the life of the plant, considered all BWR plants which utilize the Mark I containment design, and concluded that for all plants and piping systems considered the fatigue usage factor for an assumed 40-year plant life is less than 0.5. An additional 20 years of plant life would indicate a usage factor below 0.75, which is less than 1.0, satisfying the fatigue criterion. This TLAA has been projected through the period of extended operation.

4.6.1.2 Staff Evaluation

The staff reviewed LRA Section 4.6.1 to verify pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

The staff reviewed SRP Section 4.6.1 evaluation of the containment liner plates, metal containment, and penetrations sleeves, found that the PNPS code of record requires a fatigue evaluation for the torus and attached piping systems from mechanical loadings as well as thermal and anchor motions, and for this reason reviewed the torus and attached piping systems fatigue evaluation for the period of extended operation, as required by 10 CFR 54.21(d). During the audit and review, the staff asked the applicant for an estimate of the total number of 60-year actuations in the design fatigue evaluation.

The applicant's response noted that all domestic Mark I BWRs appear to meet the GE Mark I Containment Program (MPR-751) (Augmented Class 2/3 Fatigue Evaluation Method and Results for Typical Torus Attached and SRV Piping Systems, November 1982) for both the current operating license period and the period of extended operation. The applicant has tracked SRV actuations from 1992 to 2005, recorded a total of 14 within the 13-year period, and estimates project actuations for the rest of 60 years at 31 lifts. The number of SRV lifts in the first 20 years of the plant life (1972–1992) was not recorded. The lifts were more frequent in the early years; for that reason, the applicant estimated 120 for the first 20 years. Combining the early, the recorded, and the projected periods, the applicant estimates 165 lifts within 60 years.

PNPS plant-specific analysis (Teledyne Engineering Services (TES) Document TR-5310-02) states that the SRV penetrations are qualified for 7500 cycles of maximum load. On this basis, the projected CUF for 60 years is calculated as 0.022.

The staff also asked the applicant for a fatigue evaluation of the SRV discharge piping and other attached piping. The applicant's response referred to TES Document TR-5310-2 stress evaluations for various load combinations; however, it does not include a fatigue evaluation of all of the other torus-attached piping (TAP). TAP is bounded by MPR-751 which found for all plants and piping systems considered fatigue usage factors less than 0.5 for an assumed 40-year plant life. In the worst case scenario, an additional 20 years of plant life would indicate usage factors below 0.75, less than 1.0, satisfying the fatigue criterion. The staff concludes that the applicant performed an adequate evaluation to demonstrate that the fatigue usage will not exceed its allowable limit during the period of extended operation. Therefore, the staff found that the applicant has projected the torus attached piping analysis for the period of extended operation in accordance with the requirements of 10 CFR 54.21(c)(1)(ii).

The same response stated that the plant-specific analysis (TR-5310-2) addresses the SRV discharge piping and its supports as well as the main vent penetration through which the SRV discharge enters the torus. This analysis states that the SRV penetrations are qualified for 7500 cycles of maximum load and expects for the SRVs fewer than 50 cycles at maximum load and fewer than 4500 cycles at partial load. The analysis concludes, "Since the 7500 cycles of maximum loads bound both of these by such a large margin and since no other significant loads are imposed on the line, the penetration was determined to be acceptable for fatigue without further evaluation." The 40-year cycles increased by 1.5 for the period of extended operation would be only 75 maximum-load cycles and 6750 low-load cycles for a total of 6850 mixed-load cycles, fewer than the 7500 maximum load cycles permitted. The fatigue analysis for torus penetrations thus remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(i).

The applicant also indicated that the PNPS plant-specific analysis (TR-5310-2) refers to the generic GE Mark I containment program for other TAP. The results of that program (based on 40 years of operation) were that 92 percent of the TAP would have CUFs of less than 0.3 and that 100 percent would have usage factors less than 0.5. These CUFs conservatively multiplied by 1.5 show that for 60 years of operation 92 percent of the TAP would have CUFs less than 0.45 and 100 percent would have CUFs less than 0.75. These calculations have thus been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(ii).

The staff reviewed the applicant's response and finds it acceptable because it reasonably summarizes the information presented in LRA Section 4.6.1.

4.6.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of fatigue of primary containment in LRA Section A.2.2.4. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address primary containment fatigue is adequate.

4.6.1.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that, for primary containment fatigue, 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).

4.7 Other Time-Limited Aging Analyses

LRA Section 4.7 summarizes the evaluation of the following plant-specific TLAAs:

- reflood thermal shock of the reactor vessel internals
- TLAA in BWRVIP documents

4.7.1 Reflood Thermal Shock of the Reactor Vessel Internals

4.7.1.1 Summary of Technical Information in the Application

UFSAR Section 3.3.6.8 addresses reflood thermal shock of the RV internals (core shroud). This evaluation of thermal shock was considered a TLAA as it is potentially based on shroud material properties that are affected by neutron fluence.

The shroud material is Type 304 stainless steel, which is not significantly affected by irradiation.

The alternative limiting fluence analysis determined that the limiting fluence value for all fluence-dependent TLAAs is the fluence that results in the maximum allowable mean RT_{NDT} for the TLAA of the axial weld failure probability, based on the March 7, 2000, BWRVIP-05 supplemental SER. The corresponding maximum allowable fluence for this TLAA is 3.37×10^{18} n/cm^2 (E > 1.0 MeV). This fluence is the limiting fluence value identified.

If fluence remains below this limiting value during the period of extended operation the fluence will yield acceptable results for the reflood thermal TLAA. To confirm that the limiting fluence will not be reached during the period of extended operation and consequently that this TLAA will be valid to the end of the period of extended operation, Commitment 48 is added.

4.7.1.2 Staff Evaluation

For the TLAA of the reflood thermal shock of the RV internals, the applicant determined that the evaluation of this as a fluence-dependent TLAA is based on core shroud material properties that are affected by neutron fluence. The applicant stated that the core shroud material at PNPS is Type 304 stainless steel, which is not significantly affected by irradiation. The BWRVIP-35 report concluded that the service limit of Type 304 stainless steel is approached at a fluence of 8×10^{21} n/cm^2 (E > 1.0 MeV). The staff found that by setting the maximum allowable 54 EFPY fluence at t the core shroud inner surface at 8×10^{21} n/cm^2 (E > 1.0 MeV), the corresponding fluence at the RV inner surface would be significantly greater than 3.37×10^{18} n/cm^2 (E > 1.0 MeV). Therefore, the value of 3.37×10^{18} n/cm^2 (E > 1.0 MeV) based on the RV axial weld failure probability TLAA is the most limiting fluence value for all RV neutron embrittlement TLAAs. Based on this finding, the staff concluded that the applicant correctly determined that for the TLAA of the reflood thermal shock of the RV internals the maximum allowable core shroud fluence is non-limiting.

As previously discussed, the applicant provided an alternative limiting fluence analysis for closing out this TLAA. The staff reviewed and evaluated this analysis in Section 4.2.0.1 and determined that it provided an acceptable basis for closing out the TLAA for the reflood thermal shock in revised LRA Section 4.7.1. The limiting fluence value for all fluence-dependent TLAAs was determined to be 3.37×10^{18} n/cm^2 (E > 1.0 MeV) for the lower intermediate shell axial welds, at the inner surface of the RV. The staff concluded that the TLAAs had therefore been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The applicant, as part of its resolution of OI 4.2, added Commitment 48 to confirm, by June 8, 2010, that the limiting fluence will not be reached during the period of extended operation.

The staff finds the TLAA for the reflood thermal shock acceptable in accordance with 10 CFR 54.21(c)(1)(ii). As reported in SER Section 4.2, the staff has reviewed and accepted Commitment 48 and the alternative fluence analysis for resolving OI 4.2 and confirming the results of the TLAAs. Commitment 48 is hereby superseded by License Condition 4.2.6 addressed in SER Section 4.2.6. The staff, therefore, concludes that OI 4.2 is closed.

4.7.1.3 UFSAR Supplement

The applicant provided no UFSAR supplement summary description of its TLAA evaluation of reflood thermal shock of the reactor vessel internals. This was identified as OI 4.2 in the SER with OI issued in March, 2007.

In its May 17, 2007 letter, the applicant's stated UFSAR Section 3.3.6.8 addresses reflood thermal shock of the RV internals (core shroud). UFSAR Section 3.3.6.8 is addressed in SER Section 4.7.1.2 above.

4.7.1.4 Conclusion

The staff has reviewed the applicant's TLAA of the reflood thermal shock of the RV internals, as summarized in revised LRA Section 4.7.1 and has determined that the reflood thermal shock of the RV internals TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). License Condition 4.2.6 has been imposed to confirm the results of the applicant's calculation. The staff also concludes that the UFSAR Supplement contains an appropriate summary description of the TLAA for the reflood thermal shock of the RV internals for the period of extended operation, as required by 10 CFR 54.21(d).

4.7.2 TLAA in BWRVIP Documents

The BWRVIP documents identify various potential TLAAs. Those applicable to PNPS are described here.

4.7.2.1 BWRVIP-05, Reactor Vessel Circumferential Welds

4.7.2.1.1 Summary of Technical Information in the Application

LRA Section 4.7.2.1 summarizes the evaluation of reactor vessel circumferential welds for the period of extended operation. BWRVIP-05 justifies elimination of reactor vessel circumferential welds from examination. BWRVIP-74 extends this justification to the period of extended operation. LRA Section 4.2.5 reviews the TLAA for this issue.

4.7.2.1.2 Staff Evaluation

LRA Section 4.2.5 reviews the TLAA for reactor vessel circumferential weld. During the review of original LRA Section 4.2.5 to evaluate the acceptability of the applicant's analysis pursuant to 10 CFR 54.21(c)(1), the staff concluded that due to the lack of benchmarking data in support of the plant-specific RAMA fluence calculations, it was unable to authorize the 54 EFPY fluence values for use in support of the TLAA for the RV circumferential weld inspection relief. This was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant provided an alternative limiting fluence analysis for closing out this TLAA. The staff reviewed and evaluated this analysis as reported in SER Section 4.2 and determined that it provides in revised LRA Section 4.2.5 an acceptable basis for closing out the TLAA for the RV circumferential weld examination relief. The applicant determined the limiting fluence value for all fluence-dependent TLAAs to be 3.37×10^{18} n/cm^2 (E > 1.0 MeV) for the lower intermediate shell axial welds at the RV inner surface. The staff concluded that the TLAAs had therefore been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The applicant, as part of its resolution of OI 4.2, added Commitment 48 to confirm, by June 8, 2010, that the limiting fluence will not be reached during the period of extended operation.

The staff finds the TLAA for the RV circumferential weld examination relief acceptable in accordance with 10 CFR 54.21(c)(1)(ii). As reported in Section 4.2 the staff has reviewed and accepted Commitment 48 and the alternative fluence analysis for resolving OI 4.2 and confirming the results of the TLAAs. Commitment 48 is hereby superseded by License Condition 4.2.6 addressed in SER Section 4.2.6. The staff, therefore, concludes that OI 4.2 is closed.

4.7.2.1.3 UFSAR Supplement

The applicant provided in LRA Section A.2.2.1.5 an UFSAR supplement summary description of its TLAA evaluation of the RV circumferential weld inspection relief. As noted, the staff could not complete the review of LRA Section 4.2.5 and, therefore, could not complete the review of LRA Section A.2.2.1.5. This item was identified as OI 4.2 in the SER with OI issued in March 2007.

In its May 17, 2007 letter, the applicant revised LRA Section A.2.2.1.5 to include an UFSAR Supplement summary description for the TLAA of RV circumferential weld examination relief.

The applicant's revised UFSAR Supplement summary description for the TLAA of the RV circumferential weld examination relief appropriately describes how the applicant applied the alternative limiting fluence analysis described in SER Section 4.2 to close out this TLAA. The applicant's UFSAR Supplement summary description is consistent with the staff analysis for the

TLAA of the RV circumferential weld examination relief in SER Section 4.2.5.2. Based on this assessment, the staff finds the UFSAR Supplement summary description for the TLAA of the RV circumferential weld examination relief acceptable. The staff concludes that OI 4.2 is closed.

4.7.2.1.4 Conclusion

The staff has reviewed the applicant's TLAA of the RV materials circumferential weld examination relief, as summarized in revised LRA Section 4.2.5, and has determined that the RV circumferential weld examination relief TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). License Condition 4.2.6 has been imposed to confirm the results of the applicant's calculation. The staff also concludes that the UFSAR Supplement contains an appropriate summary description of the TLAA for the RV circumferential weld examination relief for the period of extended operation, as required by 10 CFR 54.21(d).

4.7.2.2 BWRVIP-48, Vessel ID Attachment Welds

4.7.2.2.1 Summary of Technical Information in the Application

LRA Section 4.7.2.2 summarizes the evaluation of vessel ID attachment welds for the period of extended operation. The BWRVIP-48 fatigue analyses for various configurations of different vessel ID bracket attachments are TLAAs. PNPS bracket configurations were included in the analysis. PNPS has no unique bracket configurations. Analysis of fatigue for 60 years showed no CUFs > 0.4. This analysis remains valid for the period of extended operation.

4.7.2.2.2 Staff Evaluation

The staff reviewed LRA Section 4.7.2.2 to verify pursuant to 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the end of the period of extended operation.

The applicant stated that the CLB and current design basis include no plant-specific CUF calculation for the RPV bracket welds and that the RPV bracket weld configurations were within the scope of those analyzed in BWRVIP-48-A, concluding that the BWRVIP-48-A generic CUF assessment would bound the RPV bracket weld design.

The staff reviewed the LRA and its supporting CLB and design basis documentation and confirmed that the applicant had calculated no plant-specific CUF for the RPV bracket welds. Consistent with its safety evaluation on BWRVIP-48-A, the staff concludes that metal fatigue of the RPV bracket welds need not be treated as a TLAA for the LRA because the CLB includes no plant-specific 40-year CUF calculation for them. Because the guidelines of BWRVIP-48-A have been approved by the staff and bound the RPV bracket welds, the staff also concludes that the BWRVIP-48-A generic CUF assessment projected for 60 years of licensed operation is a sufficient basis for management of fatigue-induced damage in these components during the period of extended operation.

4.7.2.2.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of vessel ID attachment welds in LRA Section A.2.2.5. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address vessel ID attachment welds is adequate.

4.7.2.2.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that, for vessel ID attachment welds, the analyses remain valid for the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.2.3 BWRVIP-49, Instrument Penetrations

Electric Power Research Institute (EPRI) Topical Report No. TR-108695, "BWR Vessel and Internals Project: Instrument Penetration Inspection and Flaw Evaluation Guidelines," (BWRVIP-49 (March 1998)) augments inspection recommendations and flaw evaluation guidelines established by the BWRVIP for RPV instrumentation penetration nozzles (IPNs) in BWR designs. The BWRVIP assessed the impact of license renewal on the generic metal fatigue assessment for these RPV IPNs in Section A.4, Appendix A, of the report. The NRC approved the generic fatigue assessment for RPV IPNs in a SE dated March 13, 2002. SRP-LR Section 4.3 confirms that RPV component metal fatigue analyses are time-dependent and fit the 10 CFR 54.3 TLAA definition.

4.7.2.3.1 Summary of Technical Information in the Application

The applicant states that the BWRVIP-49 generic metal fatigue analysis for the RPV IPNs is a TLAA for the LRA. LRA Section 4.3.1 states in a note to LRA Table 4.3-1 that the RPV IPNs were excluded from a 40-year design basis CUF calculation in accordance with ASME Code, Section III fatigue exclusion criteria. The applicant concludes that the BWRVIP-49 generic metal fatigue analysis applies and bounds the metal fatigue analysis for the bracket welds and that the BWRVIP-49 analysis as applied to the RPV IPNs has been projected to the expiration of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) and is acceptable.

4.7.2.3.2 Staff Evaluation

The BWRVIP's metal fatigue analysis for BWR RPV IPNs was based on a bounding generic CUF assessment. The ASME Code, Section III methods for CUF calculations apply to the BWRVIP generic assessment bounding RPV IPNs. SER Section 4.3.1.2 addresses these methods. The BWRVIP concluded that the metal fatigue CUF analyses for BWR RPV IPNs yielded CUF values less than 0.4 threshold to consider additional impact of the BWR coolant environment on the CUF calculations. BWRVIP-49 states that plant-specific metal fatigue analyses for BWR RPV IPNs must be TLAAs for BWR applications if the analyses meet the six TLAA criteria defined in 10 CFR 54.3.

The staff assessed the augmented inspection methods, flaw evaluation methods, and TLAAs for BWR RPV bracket welds in the staff's March 13, 2002, SE and concluded that the thermal cycle CUFs for all BWRs were less than 0.4 for both the current operating period and the period of extended operation and that BWR RPV IPN thermal fatigue was not a significant aging effect. However, BWRVIP-49 states that BWR license renewal applicants must address RPV IPN metal fatigue as a TLAA if they determine that plant-specific metal fatigue analyses at their facilities meet the six 10 CFR 54.3 TLAA criteria.

In its July 5, 2006 letter, the applicant claimed that the RPV IPNs were excluded from a CUF calculation in accordance with ASME Code, 1965 Edition, Section III, paragraph N–415.1. SER Section 4.3.1.2 states the staff's basis for accepting the CUF exemption for the RPV IPNs. Therefore, the applicant calculated no plant-specific CUF for the RPV IPNs. The applicant stated, however, that the RPV IPNs were within the scope of those analyzed in BWRVIP-49 and that the BWRVIP-49 generic CUF assessment would bound the RPV IPN design. Consistent with the SE on BWRVIP-49, the staff concludes that RPV IPN metal fatigue need not be treated as a TLAA for the LRA because the CLB requires no plant-specific 40-year CUF calculation for the components. The staff also concludes that the BWRVIP-49 generic CUF assessment, as projected for 60 years of licensed operation and approved in the staff's SE dated January 17, 2001, is a sufficient analysis for fatigue management in these components during the period of extended operation.

4.7.2.3.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description for the generic BWRVIP-49 fatigue analysis in LRA Section A.2.2.6. In a letter dated May 1, 2007, the applicant amended the LRA to delete the BWRVIP-49 fatigue assessment for the RPV IPNs as a TLAA for the LRA. The letter deleted LRA Section A.2.2.6. SER Section 4.7.2.3.2 states the regulatory basis for concluding that the generic fatigue analysis in EPRI Topical Report No. TR-108695 is an acceptable basis for management of fatigue-induced cracking in the RPV IPNs without the need for the generic analysis as a TLAA for the LRA.

Therefore, based on the assessment in Section 4.7.2.3.2 of this audit report, the staff accepts the deletion of LRA Section A.2.2.6.

4.7.2.3.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant's basis for deleting Section 4.7.2.3, "BWRVIP-49, Instrument Penetrations Fatigue Analysis," as a TLAA for the LRA is acceptable. The staff also accepts the applicant's basis for deleting LRA Section A.2.2.6, "Instrument Penetrations Fatigue Analysis," which otherwise would be mandated by 10 CFR 54.21(d).

4.7.2.4 BWRVIP-74, Reactor Pressure Vessel

4.7.2.4.1 Summary of Technical Information in the Application

LRA Section 4.7.2.4 summarizes the evaluation of RPV analyses for the period of extended operation. BWRVIP-74 and the staff's SER for it address the following four TLAAs:

(1) P-T Curve Analyses - The SER concludes "a set of P-T curves should be developed for the heat-up and cool-down operating conditions in the plant at a given EFPY in the LR period." LRA Section 4.2.2 addresses the P-T curves.

(2) Fatigue - The SER states that the license renewal applicant should not rely solely on the BWRVIP-74 analysis but should verify that the number of cycles assumed in the original fatigue design is conservative. The SER also states that staff environmental fatigue concerns were not resolved and that each applicant should address environmental fatigue for the components covered by BWRVIP-74. LRA Section 4.3 addresses RPV fatigue.

(3) Equivalent Margins Analysis for RPV Materials with Charpy USE Less than 50 ft-lb - BWRVIP-74 states that the percentage reduction in C_VUSE for beltline materials is less than those specified for limiting BWR/3-6 plates and non-Linde 80 submerged arc welds. This statement is not applicable to PNPS because projected C_VUSE remains above the 50 ft-lb limit throughout the period of extended operation. LRA Section 4.2.3 addresses C_VUSE for RPV materials.

(4) Material Evaluation for Exempting RPV Circumferential Welds from Inspection - LRA Section 4.2.5 addresses the RPV circumferential weld inspection relief.

4.7.2.4.2 Staff Evaluation

The staff's evaluation of the P-T curve analyses, fatigue, C_VUSE, and the reactor vessel circumferential welds inspection relief is documented in SER Sections 4.2.2, 4.3, 4.2.3, and 4.2.5, respectively.

4.7.2.4.3 Conclusion

As noted above, the staff's evaluation and conclusion for the P-T curve analyses, fatigue, C_VUSE, and the reactor vessel circumferential welds inspection relief are documented in SER Sections 4.2.2, 4.3, 4.2.3, and 4.2.5, respectively.

4.7.2.5 BWRVIP-76, Core Shroud

4.7.2.5.1 Summary of Technical Information in the Application

LRA Section 4.7.2.5 summarizes the evaluation of core shroud fatigue for the period of extended operation. BWRVIP-76, Appendix K, states that plant-specific analyses for shroud fatigue are reviewed for a TLAA. A review of the reactor vessel and internals design basis document determined that the only TLAA was the fatigue analysis and calculation of shroud repair CUFs.

4.7.2.5.2 Staff Evaluation

The staff reviewed LRA Section 4.7.2.5 to verify pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

The staff reviewed the applicant's TLAA on core shroud metal fatigue and in particular the CUF assessment for the core shroud tie rods and evaluated this TLAA in SER Section 4.3.1.2.2.2. The evaluation includes basis for the staff's conclusion that the CUF value for the core shroud tie rods is valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). The applicant has credited the BWR Internals Program to manage fatigue-induced cracking in the remaining RPV internals. The staff evaluates the applicant's basis for crediting the BWR Internals Program with management of fatigue-induced damage in these RPV internals in SER Section 3.1.2.2.1.

4.7.2.5.3 UFSAR Supplement

The applicant provided an UFSAR supplement summary description of its TLAA evaluation of core shroud fatigue in LRA Section A.2.2.2.1. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address core shroud fatigue is adequate.

4.7.2.5.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that, for core shroud fatigue, 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).

4.8 Conclusion for Time-Limited Aging Analyses

The staff reviewed the information in LRA Section 4, "Time-Limited Aging Analyses." On the basis of its review the staff concludes that the applicant has provided an adequate list of TLAAs, as defined in 10 CFR 54.3. Further, the staff concludes that the applicant demonstrated that: (1) the TLAAs will remain valid for the period of extended operation, as required by 10 CFR 54.21(c)(1)(i); (2) the TLAAs have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii); or (3) that the aging effects will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). The staff also reviewed the FSAR supplement for the TLAAs and found that the FSAR supplement contains descriptions of the TLAAs sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes, that no plant-specific exemptions are in effect that are based on TLAAs, as required by 10 CFR 54.21(c)(2).

With regard to these matters, the staff concludes, that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the CLB, and that any changes made to the CLB, in order to comply with 10 CFR 54.21(c), are in accordance with the Atomic Energy Act of 1954, and the NRC's regulations.

SECTION 5

REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In accordance with Title 10, Part 54, of the *Code of Federal Regulations*, the Advisory Committee on Reactor Safeguards (ACRS) has reviewed the license renewal application (LRA) for Pilgrim Nuclear Power Station.

On April 4, 2007, the applicant presented its LRA, and the NRC staff, including Region I personnel, presented its review findings, as contained in the safety evaluation report (SER) with open items dated March 1, 2007, to the ACRS Plant License Renewal Subcommittee.

On September 6, 2007, the applicant presented its LRA, and the NRC staff, including Region I personnel, presented its review findings, as contained in the final SER dated June 28, 2007, to the ACRS Plant License Renewal Full Committee.

During the 545th meeting of the ACRS on September 6, 2007, the ACRS completed its review of the PNPS LRA and the staff SER. The ACRS documented its findings in a letter to the Commission dated September 26, 2007. A copy of this letter is provided on the following pages of this SER Section.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

ACRSR-2265

September 26, 2007

The Honorable Dale E. Klein
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE LICENSE RENEWAL APPLICATION FOR THE PILGRIM NUCLEAR POWER STATION

Dear Chairman Klein:

During the 545th meeting of the Advisory Committee on Reactor Safeguards (ACRS), September 6-8, 2007, we completed our review of the license renewal application for the Pilgrim Nuclear Power Station (PNPS) and the final Safety Evaluation Report (SER) prepared by the NRC staff. Our Plant License Renewal Subcommittee also reviewed this matter during a meeting on April 4, 2007. During our review, we had the benefit of discussions with representatives of the NRC staff, and Entergy Nuclear Operations, Inc., (the applicant). We also had the benefit of the documents referenced. This report fulfills the requirement of 10 CFR 54.25 that the ACRS review and report on all license renewal applications.

CONCLUSIONS AND RECOMMENDATION

1. The programs established and commitments made by the applicant to manage age-related degradation provide reasonable assurance that PNPS can be operated in accordance with its current licensing basis for the period of extended operation without undue risk to the health and safety of the public.

2. The license conditions proposed by the staff are appropriate.

3. The application of Entergy Nuclear Operations, Inc., for renewal of the operating license for PNPS should be approved with the proposed license conditions.

BACKGROUND AND DISCUSSION

PNPS is located approximately four miles southeast of Plymouth, Massachusetts. The NRC issued the PNPS construction permit on August 26, 1968, and the operating license on June 8, 1972. PNPS is a BWR-3 design with a Mark 1 containment. General Electric supplied the nuclear steam supply system and Bechtel Corporation originally designed and constructed the balance of plant. The PNPS licensed power output is 2028 megawatts thermal with a gross electrical output of approximately 690 megawatts. The applicant requested renewal of the PNPS operating license for 20 years beyond the current license term, which expires on June 8, 2012.

the plant site. The staff reviewed the applicant's identification of structures, systems, and components (SSCs) that are within the scope of license renewal; the integrated plant assessment process; the applicant's identification of the plausible aging mechanisms associated with passive, long-lived components; the adequacy of the applicant's aging management programs (AMPs); and the identification and assessment of time-limited aging analyses (TLAAs) requiring review.

The application either demonstrates consistency with the Generic Aging Lessons Learned (GALL) Report or documents deviations from the approaches specified in the GALL Report. The staff reviewed this application in accordance with NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants."

The applicant identified those SSCs that fall within the scope of license renewal. For these SSCs, the applicant performed a comprehensive aging management review. Based on the results of this review, the applicant will implement 40 AMPs for license renewal including existing, enhanced, and new programs. In the SER, the staff concludes that the applicant has appropriately identified SSCs within the scope of license renewal and that the AMPs described by the applicant are appropriate and sufficient to manage the aging of long-lived passive components that are within the scope of license renewal. We concur with this conclusion.

The staff conducted inspections and audits. The purpose of the inspections was to verify that the scoping and screening methodologies are consistent with the regulations and are adequately reflected in the application. The audits confirmed the appropriateness of the AMPs and the aging management reviews. Based on the inspections and audit, the staff concluded that these programs are consistent with the descriptions contained in the license renewal application. The staff also concluded that the existing programs, to be credited as AMPs for license renewal, are generally functioning well and that the applicant has established an implementation plan in its commitment tracking system to ensure timely completion of the license renewal commitments.

PNPS has a history of seepage of small amounts of water on the torus room floor. The water has been tested and the applicant has determined that it is non-aggressive ground water as defined in the GALL Report. Further analyses and evaluations performed by the applicant have shown that the probable source of the water is groundwater intrusion through construction joints in the basemat. The seepage of water through the 8-foot thick reactor building basemat is a highly localized phenomenon and the inflow is offset by evaporation such that the small accumulations do not require removal by other means.

An assessment performed by a civil engineering consultant for the applicant concluded that the seepage does not compromise the overall structural performance of the torus basemat and does not affect the bulk integrity of the concrete slab or the overall compressive and bending load bearing capacity of the reactor foundation. This assessment verified the non-aggressiveness of the water and concluded that the localized calcium leaching does not affect the overall structural performance of the slab. The staff agreed with the applicant's assessment but requested additional monitoring to provide assurance that the conclusions remain valid during the period of extended operation. The applicant committed to continue monitoring the chemistry of the water in the torus room prior to the period of extended operation and once every 5 years during the period of extended operation. The applicant further committed to inspect the torus room structures in accordance with the Structures Monitoring Program every 5 years. The staff concluded that the applicant's programs and commitments relative to the water intrusion met the requirements for license renewal. We concur with the staff's conclusion.

The applicant identified the systems and components requiring TLAAs and reevaluated them for 20 years of extended operation. Affected TLAAs include those associated with neutron embrittlement, metal fatigue, irradiation-assisted stress corrosion cracking, environmental qualification of electrical equipment, and stress relaxation of hold-down bolts. The staff concluded that the applicant has provided an adequate list of TLAAs. We concur with this conclusion.

For the TLAAs associated with neutron embrittlement, the applicant used the Radiation Analysis Modeling Application (RAMA) fluence methodology for its reactor vessel fluence evaluations. RAMA is an NRC-approved methodology, but it has not been benchmarked for BWR-3 designs. The calculations of fluence must be benchmarked against at least one credible plant-specific surveillance capsule. The applicant has not completed its benchmarking of the RAMA code for PNPS due to discrepancies between the fluence values obtained from the RAMA code and the dosimetry data. An alternative analysis provided by the applicant showed that substantial margin exists for the most limiting components and that the fluence used for the TLAAs was conservative. However, the staff required that the applicant provide a correctly benchmarked analysis for the period of extended operation that meets regulatory requirements. The applicant plans to remove a capsule during a future outage after precisely measuring its location and plans to perform an analysis using this capsule to complete the benchmarking. In parallel, the applicant is working with the Electric Power Research Institute (EPRI) to benchmark the code using data from another BWR-3. The staff concluded that either of these approaches could meet the regulatory requirements.

The applicant has committed to complete an analysis that meets the regulatory requirements and submit it to the NRC for approval before entering the period of extended operation. The results of the completed analysis will be reviewed against the fluence values used for the TLAAs to ensure that the values used were conservative. The staff has concluded that this approach is acceptable and has proposed a license condition that would require the analysis to be submitted to the staff on or before June 8, 2010. We concur with the staff's conclusion and the proposed license condition.

The applicant initially took exception to the GALL Report for the manner in which environmental effects were taken into account in the fatigue analyses. After further discussion with the staff, the applicant made the commitment to be consistent with the GALL Report. The staff will issue a supplement to the final SER to document this commitment. The supplement to the SER was not available for our review, but we concur with the staff's resolution of this issue as discussed at the meeting.

With the addition of the above commitments, the staff concluded that the applicant meets the requirements of the license renewal rule by demonstrating that the TLAAs will remain valid for the period of extended operation, or that the TLAAs have been projected to the end of the period of extended operation, or that the aging effects will be adequately managed for the period of extended operation. We concur with the staff's conclusion that TLAAs have been properly identified and that criteria supporting 20 more years of operation have been met.

We agree with the staff that there are no issues related to the matters described in 10 CFR 54.29(a)(1) and (a)(2) that preclude renewal of the operating license for PNPS. The programs established and the commitments made by the applicant provide reasonable assurance that PNPS can be operated in accordance with its current licensing basis for the period of extended operation without undue risk to the health and safety of the public. The application for renewal of the operating license for PNPS should be approved with the proposed license conditions.

Sincerely,

/RA/

William J. Shack
Chairman

References

1. Safety Evaluation Report Related to the License Renewal of Pilgrim Nuclear Power Station, June 28, 2007.
2. Safety Evaluation Report With Open Items Related to the License Renewal of Pilgrim Nuclear Power Station, March 2007.
3. Letter from M. A. Balduzzi to NRC, Pilgrim Nuclear Power Station License Renewal Application, January 25, 2006.
4. Audit and Review Report for Plant Aging Management Review and Programs, Pilgrim Nuclear Power Station, November 1, 2006.
5. Letter from Richard J. Conte, NRC to Kevin Bronson, Entergy, Pilgrim Nuclear Power Station - NRC License Renewal Inspection Report 05000293/2006007, March 15, 2007.
6. Letter from S. Bethay, Entergy to NRC, License renewal Application Amendment (including an assessment by a civil engineering consultant), May 1, 2007.

SECTION 6

CONCLUSION

The staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff) reviewed the license renewal application (LRA) for Pilgrim Nuclear Power Station in accordance with NRC regulations and US NRC 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 determines that the requirements of 10 CFR 54.29(a) have been met.

The staff noted that any requirements of 10 CFR Part 51, Subpart A, are documented in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)," draft Supplement 29, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Pilgrim Nuclear Power Station," dated December 2006.

APPENDIX A

PNPS LICENSE RENEWAL COMMITMENTS

During the review of the Pilgrim Nuclear Power Station (PNPS) license renewal application (LRA) by the staff of the US Nuclear Regulatory Commission (NRC) (the staff), Entergy Nuclear Operations, Inc. (the applicant), made commitments related to aging management programs (AMPs) to manage the aging effects of structures and components prior to the period of extended operation. The following table lists these commitments along with the implementation schedules and the sources for each commitment.

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	**Commitment**	**LRA Section(s)**	**Enhancement or Implementation Schedule**	**Source**
1	Implement the Buried Piping and Tanks Inspection Program as described in LRA Section B.1.2.	B.1.2	June 8, 2012	Letters 2.06.003 and 2.06.057
2	Enhance the implementing procedure for ASME Section XI inservice inspection and testing to specify that the guidelines in Generic Letter 88-01 or approved BWRVIP-75 shall be considered in determining sample expansion if indications are found in Generic Letter 88-01 welds.	B.1.6	June 8, 2012	Letters 2.06.003 and 2.06.057
3	Inspect fifteen (15) percent of the top guide locations using enhanced visual inspection technique, EVT-1, within the first 18 years of the period of extended operation, with at least one-third of the inspections to be completed within the first six (6) years and at least two-thirds within the first 12 years of the period of extended operations. Locations selected for examination will be areas that have exceeded the neutron fluence threshold.	B.1.8	Inspections completed within the first 18 years of the period of extended operation (at least one-third of these inspections completed within the first six years and at least two-thirds completed within the first 12 years)	Letters 2.06.003, 2.06.057, 2.06.064, and 2.06.081

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	**Commitment**	**LRA Section(s)**	**Enhancement or Implementation Schedule**	**Source**
4	Enhance the Diesel Fuel Monitoring Program to include quarterly sampling of the security diesel generator fuel storage tank. Particulates (filterable solids), water and sediment checks will be performed on the samples. Filterable solids acceptance criteria will be = 10 mg/l. Water and sediment acceptance criteria will be = 0.05%.	B.1.10	June 8, 2012	Letters 2.06.003, 2.06.057, and 2.06.089
5	Enhance the Diesel Fuel Monitoring Program to install instrumentation to monitor for leakage between the two walls of the security diesel generator fuel storage tank to ensure that significant degradation is not occurring.	B.1.10	June 8, 2012	Letters 2.06.003 and 2.06.057
6	Enhance the Diesel Fuel Monitoring Program to specify acceptance criterion for UT measurements of emergency diesel generator fuel storage tanks (T-126A&B).	B.1.10	June 8, 2012	Letters 2.06.003 and 2.06.057

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	Commitment	LRA Section(s)	Enhancement or Implementation Schedule	Source
7	Enhance Fire Protection Program procedures to state that the diesel engine subsystems (including the fuel supply line) shall be observed while the pump is running. Acceptance criteria will be enhanced to verify that the diesel engine did not exhibit signs of degradation while it was running; such as fuel oil, lube oil, coolant, or exhaust gas leakage. Also, enhance procedures to clarify that the diesel-driven fire pump engine is inspected for evidence of corrosion in the intake air, turbocharger, and jacket water system components as well as lube oil cooler. The jacket water heat exchanger is inspected for evidence of corrosion or buildup to manage loss of material and fouling on the tubes. Also, the engine exhaust piping and silencer are inspected for evidence of internal corrosion or cracking.	B.1.13.1	June 8, 2012	Letters 2.06.003, 2.06.057, and 2.06.064
8	Enhance the Fire Protection Program procedure for Halon system functional testing to state that the Halon 1301 flex hoses shall be replaced if leakage occurs during the system functional test.	B.1.13.1	June 8, 2012	Letters 2.06.003 and 2.06.057
9	Enhance Fire Water System Program procedures to include inspection of hose reels for corrosion. Acceptance criteria will be enhanced to verify no significant corrosion.	B.1.13.2	June 8, 2012	Letters 2.06.003 and 2.06.057

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	Commitment	LRA Section(s)	Enhancement or Implementation Schedule	Source
10	Enhance the Fire Water System Program to state that a sample of sprinkler heads will be inspected using guidance of NFPA 25 (2002 Edition) Section 5.3.1.1.1. NFPA 25 also contains guidance to repeat this sampling every 10 years after initial field service testing.	B.1.13.2	June 8, 2012	Letters 2.06.003 and 2.06.057
11	Enhance the Fire Water System Program to state that wall thickness evaluations of fire protection piping will be performed on system components using nonintrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to corrosion. These inspections will be performed before the end of the current operating term and at intervals thereafter during the period of extended operation. Results of the initial evaluations will be used to determine the appropriate inspection interval to ensure aging effects are identified prior to loss of intended function.	B.1.13.2	June 8, 2012	Letters 2.06.003 and 2.06.057
12	Implement the Heat Exchanger Monitoring Program as described in LRA Section B.1.1 5.	B.1.15	June 8, 2012	Letters 2.06.003 and 2.06.057
13	Enhance the Instrument Air Quality Program to include a sample point in the standby gas treatment and torus vacuum breaker instrument air subsystem in addition to the instrument air header sample points.	B.1.17	June 8, 2012	Letters 2.06.003 and 2.06.057

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	**Commitment**	**LRA Section(s)**	**Enhancement or Implementation Schedule**	**Source**
14	Implement the Metal-Enclosed Bus Inspection Program as described in LRA Section B.1.18.	B.1.18	June 8, 2012	Letters 2.06.003 and 2.06.057
15	Implement the Non-EQ Inaccessible Medium-Voltage Cable Program as described in LRA Section B.1.19. Include developing a formal procedure to inspect manholes for in-scope medium voltage cable.	B.1.19	June 8, 2012	Letters 2.06.003 and 2.06.057
16	Implement the Non-EQ Instrumentation Circuits Test Review Program as described in LRA Section B.1.20.	B.1.20	June 8, 2012	Letters 2.06.003 and 2.06.057
17	Implement the Non-EQ Insulated Cables and Connections Program as described in LRA Section B.1.21.	B.1.21	June 8, 2012	Letters 2.06.003 and 2.06.057
18	Enhance the Oil Analysis Program to periodically change CRD pump lubricating oil. A particle count and check for water will be performed on the drained oil to detect evidence of abnormal wear rates, contamination by moisture, or excessive corrosion.	B.1.22	June 8, 2012	Letters 2.06.003 and 2.06.057

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	Commitment	LRA Section(s)	Enhancement or Implementation Schedule	Source
19	Enhance Oil Analysis Program procedures for security diesel and reactor water cleanup pump oil changes to obtain oil samples from the drained oil. Procedures for lubricating oil analysis will be enhanced to specify that a particle count and check for water are performed on oil samples from the fire water pump diesel, security diesel, and reactor water cleanup pumps.	B.1.22	June 8, 2012	Letters 2.06.003 and 2.06.057
20	Implement the One-Time Inspection Program as described in LRA Section B.1.23.	B.1.23	June 8, 2012	Letters 2.06.003, 2.06.057, and 2.07.023
21	Enhance the Periodic Surveillance and Preventive Maintenance Program as necessary to assure that the effects of aging will be managed as described in LRA Section B.1.24.	B.1.24	June 8, 2012	Letters 2.06.003 and 2.06.057
22	Enhance the Reactor Vessel Surveillance Program to proceduralize the data analysis, acceptance criteria, and corrective actions described in LRA Section B.1.26.	B.1.26	June 8, 2012	Letters 2.06.003 and 2.06.057
23	Implement the Selective Leaching Program in accordance with the program as described in LRA Section B.1.27.	B.1.27	June 8, 2012	Letters 2.06.003 and 2.06.057

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	Commitment	LRA Section(s)	Enhancement or Implementation Schedule	Source
24	Enhance the Service Water Integrity Program procedure to clarify that heat transfer test results are trended.	B.1.28	June 8, 2012	Letters 2.06.003 and 2.06.057
25	Enhance the Structures Monitoring Program procedure to clarify that the discharge structure, security diesel generator building, trenches, valve pits, manholes, duct banks, underground fuel oil tank foundations, manway seals and gaskets, hatch seals and gaskets, underwater concrete in the intake structure, and crane rails and girders are included in the program. In addition, the Structures Monitoring Program will be revised to require opportunistic inspections of inaccessible concrete areas when they become accessible.	B.1.29.2	June 8, 2012	Letters 2.06.003 and 2.06.057
26	Enhance Structures Monitoring Program guidance for performing structural examinations of elastomers (seals, gaskets, seismic joint filler, and roof elastomers) to identify cracking and change in material properties.	B.1.29.2	June 8, 2012	Letters 2.06.003 and 2.06.057
27	Enhance the Water Control Structures Monitoring Program scope to include the east breakwater, jetties, and onshore revetments in addition to the main breakwater.	B.1.29.3	June 8, 2012	Letters 2.06.003 and 2.06.057

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	**Commitment**	**LRA Section(s)**	**Enhancement or Implementation Schedule**	**Source**
28	Enhance System Walkdown Program guidance documents to perform periodic system engineer inspections of systems in-scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(1) and (a)(3). Inspections shall include areas surrounding the subject systems to identify hazards to those systems. Inspections of nearby systems that could impact the subject systems will include SSCs that are in-scope and subject to aging management review for license renewal in accordance with 10 CFR 54.4(a)(2).	B.1.30	June 8, 2012	Letters 2.06.003 and 2.06.057
29	Implement the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program as described in LRA Section B.1.31.	B.1.31	June 8, 2012	Letters 2.06.003 and 2.06.057
30	Perform a code repair of the CRD return line nozzle to cap weld if the installed weld repair is not approved via accepted code cases, revised codes, or an approved relief request for subsequent inspection intervals.	B.1.3	June 30, 2015	Letter 2.06.057
31	At least 2 years prior to entering the period of extended operation, for the locations identified in NUREG/CR-6260 for BWRs of the PNPS vintage, PNPS will refine our current fatigue analyses to include the effects of reactor water environment and verify that the cumulative usage factors (CUFs) are less than 1. This includes applying the appropriate Fen [sic] factors to valid CUFs	4.3.3	June 8, 2012 June 8, 2010 for submitting the AMP if PNPS selects the option of managing the	Letters 2.06.057, 2.06.064, 2.06.081, 2.07.005, 2.007.064

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	**Commitment**	**LRA Section(s)**	**Enhancement or Implementation Schedule**	**Source**
	determined in accordance with one of the following: 1. For locations, including NUREG/CR-6260 locations, with existing fatigue analysis valid for the period of extended operation, use the existing CUF to determine the environmentally adjusted CUF. 2. More limiting PNPS-specific locations with a valid CUF may be added in addition to the NUREG/CR-6260 locations. 3. Representative CUF values from other plants, adjusted to or enveloping the PNPS plant specific external loads may be used if demonstrated applicable to PNPS. 4. An analysis using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case) may be performed to determine a valid CUF. During the period of extended operation, PNPS may also use one of the following options for fatigue management if ongoing monitoring indicates a potential for a condition outside the analysis bounds noted above: 1. Update and/or refine the affected analyses described above.		affects of aging due to environmentally assisted fatigue	

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	**Commitment**	**LRA Section(s)**	**Enhancement or Implementation Schedule**	**Source**
	2. Implement an inspection program that has been reviewed and approved by the NRC (e.g., periodic nondestructive examination of the affected locations at inspection intervals to be determined by a method acceptable to the NRC). 3. Repair or replace the affected locations before exceeding a CUF of 1.0.			
32	Implement the enhanced Bolting Integrity Program described in Attachment C of Pilgrim License Renewal Application Amendment 5 (Letter 2.06.064).		June 8, 2012	Letters 2.06.057, 2.06.064, and 2.06.081
33	PNPS will inspect the inaccessible jet pump thermal sleeve and core spray thermal sleeve welds if and when the necessary technique and equipment become available and the technique is demonstrated by the vendor, including delivery system.		As stated in the commitment	Letter 2.06.057
34	Within the first 6 years of the period of extended operation and every 12 years thereafter, PNPS will inspect the access hole covers with UT methods. Alternatively, PNPS will inspect the access hole covers in accordance with BWRVIP guidelines should such guidance become available.		June 8, 2018	Letter 2.06.057 and 2.06.089
35	At least 2 years prior to entering the period of extended		June 8, 2012	Letters

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	Commitment	LRA Section(s)	Enhancement or Implementation Schedule	Source
	operation, for reactor vessel components, including the feedwater nozzles, PNPS will implement one or more of the following: (1) Refine the fatigue analyses to determine valid CUFs less than 1. Determine valid CUFs based on numbers of transient cycles projected to be valid for the period of extended operation. Determine CUFs in accordance with an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case). (2) Manage the effects of aging due to fatigue at the affected locations by an inspection program that 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). (3) Repair of replace the affected locations before exceeding a CUF of 1.0. Should PNPS select the option to manage the aging effects due to fatigue during the period of extended operation, details of the AMP such as scope, qualification, method, and frequency will be submitted to the NRC at least 2 years prior to the period of extended operation.		June 8, 2010 for submitting the AMP if PNPS selects the option of managing the affects of aging	2.06.057, 2.06.064, and 2.06.081

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	Commitment	LRA Section(s)	Enhancement or Implementation Schedule	Source
36	To ensure that significant degradation on the bottom of the condensate storage tank is not occurring, a one-time ultrasonic thickness examination in accessible areas of the bottom of the condensate storage tank will be performed. Standard examination and sampling techniques will be utilized.		June 8, 2012	Letter 2.06.057
37	The BWR Vessel Internals Program includes inspections of the steam dryer. Inspections of the steam dryer will follow the guidelines of BWRVIP-139 and General Electric SIL 644 Revision 1.	A.2.1.8 / Conference call on September 25, 2006	June 8, 2012	Letter 2.06.089
38	Enhance the Diesel Fuel Monitoring Program to include periodic ultrasonic thickness measurement of the bottom surface of the diesel fire pump day tank. The first ultrasonic inspection of the bottom surface of the diesel fire pump day tank will occur prior to the period of extended operation, following engineering analysis to determine acceptance criteria and test locations. Subsequent test intervals will be determined based on the first inspection results.	B.1.10	June 8, 2012	Letter 2.06.089
39	Perform a one-time inspection of the Main Stack foundation prior to the period of extended operation.	B.1.23	June 8, 2012	Letter 2.06.094

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	**Commitment**	**LRA Section(s)**	**Enhancement or Implementation Schedule**	**Source**
40	Enhance the Oil Analysis Program by documenting program elements 1 through 7 in controlled documents. The program elements will include enhancements identified in the PNPS license renewal application and subsequent amendments to the application. The program will include periodic sampling for the parameters specified under the Parameters Monitored/Inspected attribute of NUREG-1801 Section XI.M39, Lubricating Oil Analysis. The controlled documents will specify appropriate acceptance criteria and corrective actions in the event acceptance criteria are not met. The basis for acceptance criteria will be defined.	B.1.22	June 8, 2012	Letter 2.06.094
41	Enhance the Containment Inservice Inspection (CII) Program to require augmented inspection in accordance with ASME Code Section XI IWE-1240, of the drywell shell adjacent to the sand cushion following indications of water leakage into the annulus air gap.	A.2.1.17 and B.1.16.1	June 8, 2012	Letter 2.06.094
42	Implement the Bolted Cable Connections Program, described in Attachment C of Pilgrim License Renewal Application 11 (Letter 2.07.003), prior to the period of extended operation.	A.2.1.40 and B.1.34	June 8, 2012	Letter 2.07.003

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	**Commitment**	**LRA Section(s)**	**Enhancement or Implementation Schedule**	**Source**
43	Include within the Structures Monitoring Program provisions to ensure groundwater samples are evaluated periodically to assess the aggressiveness of groundwater to concrete, as described in Attachment E of License Renewal Application 12 (Letter 2.07.005), prior to the period of extended operation.	A.2.1.32 and B.1.29.2	June 8, 2012	Letter 2.07.005
44	Perform another set of the UT measurements just above and adjacent to the sand cushion region prior to the period of extended operation and once within the first 10 years of the period of extended operation.	A.2.1.17 and B.1.16.1	Prior to the period of extended operation and once within the first 10 years of the period of extended operation	Letter 2.0.7.010
45	If groundwater continues to collect on the Torus Room floor, obtain samples and test such water to determine its pH and verify the water is non-aggressive as defined in NUREG-1801 Section III.A1 item III.A.1-4 once prior to the period of extended operation and once every five years during the period of extended operation.	A.2.1.32 and B.1.29.2	June 8, 2012	Letters 2.07.010 2.07.027, and 2.07.029
46	Inspect the condition of a sample of the torus hold-down bolts and associated grout and determine appropriate actions based on the findings prior to the period of extended operation.	A.2.1.32 and B.1.29.2	June 8, 2012	Letter 2.07.027

APPENDIX A: PNPS LICENSE RENEWAL COMMITMENTS				
Number	Commitment	LRA Section(s)	Enhancement or Implementation Schedule	Source
47	Submit to the NRC an action plan to improve benchmarking data to support approval of new P-T curves for Pilgrim.	4.2.2, A.2.2.1.1, and A.2.2.1.2	September 15, 2007	Letter 2.07.027
48	On or before June 8, 2010, Entergy will submit to the NRC calculations consistent with Regulatory Guide 1.190 that will demonstrate limiting fluence values will not be reached during the period of extended operation.	4.2, 4.7.1, A.1.1 and A.2.2.1	June 8, 2010	Letter 2.07.027

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 Entergy Nuclear Operations, Inc. (ENO). This appendix also contains other correspondence regarding the staff's review of the Pilgrim Nuclear Power Station (PNPS) license renewal application (LRA) (under Docket No. 50-293).

APPENDIX B: CHRONOLOGY	
Date	**Subject**
January12, 2006	G20060064/LTR-06-0041 - Sen T. Murray, Rep V. DeMacedo, and Rep T. O'Brien Ltr re: Relicensing of Pilgrim and Vermont Yankee (ADAMS Accession No. ML060230046)
January 13, 2006	G20060054/LTR-06-0037 - Ltr. Alice Moore Re: Concerns Pilgrim and Vermont Yankee Relicensing. (ADAMS Accession No. ML060190039)
January 13, 2006	Letter from W. Bramhall on Proposed Rule PR-73 - Regarding Design Basis Threat. (ADAMS Accession No. ML060180196)
January 18, 2006	G20060065/LTR-06-0042 - Ltr Mark D. Sylvia re: Concerns Pilgrim and Vermont Yankee Relicensing Applications. (ADAMS Accession No. ML060230048)
January 20, 2006	Letter from Pilgrim Security Watch, M. Lampert, et al. E. J. Epstein, N. Cohen, S. J. Goodman, R. Becker, D. Katz and H. Moyer on Proposed Rule PR-73 - Regarding Design Basis Threat (ADAMS Accession No. ML060240587)
January 25, 2006	Letter from M. A. Balduzzi to NRC Submitting Pilgrim Nuclear Power Station License Renewal Application. (ADAMS Accession No. ML060300026)
January 25, 2006	Letter from M. A. Balduzzi to NRC Submitting License Renewal Application Boundary Drawings. (ADAMS Accession No. ML060470248)
January 25, 2006	Pilgrim Nuclear Power Station License Renewal Application. (ADAMS Accession No. ML060300028)
January 25, 2006	Pilgrim Nuclear Power Station Applicant's Environmental Report Operating License Renewal Stage, Appendix E. (ADAMS Accession No. ML060830611)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
January 27, 2006	Email: (PA) Receipt of License Renewal Applications for VY and Pilgrim (ADAMS Accession No. ML062120498)
January 27, 2006	G20050841/LTR-05-0588-Mary Elizabeth Lampert Ltr. Re. Pilgrim Nuclear Power Station Email Concerns Single Loop Operation Amendment. (ADAMS Accession No. ML060260021)
January 31, 2006	NRC Press Release-06-011: NRC Announces Availability of License Renewal Applications for Vermont Yankee and Pilgrim. (ADAMS Accession No. ML060310043)
January 31, 2006	Receipt and Availability of the License Renewal Application for the Pilgrim Nuclear Power Station. (ADAMS Accession No. ML060310593)
February 3, 2006	Letter from R. Schaff, NRC to D. O'Brien - Regarding Maintenance of Reference Material at the Plymouth Public Library for the Pilgrim Nuclear Power Station License Renewal Application. (ADAMS Accession No. ML060370581)
February 13, 2006	Notice of Forthcoming Public Information Session for the U.S. Nuclear Regulatory Commission (NRC) Staff to Describe the License Renewal Process. (ADAMS Accession No. ML060440543)
February 25, 2006	G20060054/LTR-06-0037 - Alice Moore Ltr. Re. Concerns Pilgrim and Vermont Yankee Relicensing. (ADAMS Accession No. ML060240024)
February 25, 2006	G20060065/LTR-06-0042 - Mark Sylvia Ltr. Re Concerns Pilgrim and Vermont Yankee relicensing applications. (ADAMS Accession No. ML060250068)
February 27, 2006	G20060064/LTR-06-0041 - Rep. V. DeMacedo and Rep. T. O'Brien Ltr. Re. Concerns relicensing of Pilgrim and Vermont Yankee. (ADAMS Accession No. ML060340238)
February 27, 2006	G20060064/LTR-06-0041 - Sen. T. Murray Ltr. Re. Concerns relicensing of Pilgrim and Vermont Yankee. (ADAMS Accession No. ML060240309)
February 28, 2006	Email: (PA) Closeout: G20060065/LTR-06-0042 - Relicensing of Pilgrim and Vermont Yankee (ADAMS Accession No. ML062120549)
March 1, 2006	NRC Press Release-I-06-011: NRC To Hold March 8th Public Meeting In Plymouth, Mass., On License Renewal Application For Pilgrim Nuclear Plant. (ADAMS Accession No. ML060600528)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
March 21, 2006	Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing - Regarding the Application from Entergy Nuclear Operations, Inc., for Renewal of the Operating License for the Pilgrim Nuclear Power. (ADAMS Accession No. ML060800745)
March 22, 2006	NRC Press Release-06-040: NRC Announces Opportunity to Request a Hearing on Application to Renew Operating License for Pilgrim Nuclear Power Station. (ADAMS Accession No. ML060810457)
March 29, 2006	NRC Contact Report - Arrange Meeting with Town Officials During Site Audit (Intergovernmental). (ADAMS Accession No. ML063470176)
March 30, 2006	Email: (Intergovernmental) Re: Pilgrim Audit. (ADAMS Accession No. ML063470309)
March 30, 2006	Email: (PA) PNPS Audit Plan. (ADAMS Accession No. ML062480291)
March 31, 2006	Email: (PA) Re: Request - License Renewal Work for CFEB (ADAMS Accession No. ML062120629)
April 3, 2006	NRC Contact Report - Arrange meeting with Town personnel during May Site Audit (Intergovernmental). (ADAMS Accession No. ML063470180)
April 3, 2006	Email: (PA) Re: Request - License Renewal Work for CFEB (ADAMS Accession No. ML062120631)
April 4, 2006	Email: (PA) Pilgrim Audit Plan (ADAMS Accession No. ML062480085)
April 5, 2006	NRC Contact Report - Follow Up from 4/3/06 Telephone Call (Intergovernmental). (ADAMS Accession No. ML063470183)
April 5, 2006	NRC Contact Report - Arrange meeting with Town personnel during Site Audit in May [4/5/06] (Intergovernmental). (ADAMS Accession No. ML063470189)
April 6, 2006	Email: (Intergovernmental) Re: Pilgrim Audit [List for Plymouth meeting]. (ADAMS Accession No. ML063470313)
April 6, 2006	Email: (PA) Questions counts... (ADAMS Accession No. ML062120636)
April 7, 2006	Email: (PA) AMP, AMR, and TLAA questions for PNPS (ADAMS Accession No. ML062120642)
April 10, 2006	NRC Contract Report - Arrange Meeting with Planning Council Staff During Site Audit in May (Intergovernmental). (ADAMS Accession No. ML063470164)

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Date	**Subject**
April 12, 2006	Email: (Intergovernmental) May 4 meeting - Pilgrim NPS license renewal [List for Carver meeting]. (ADAMS Accession No. ML063470329)
April 12, 2006	Email: (Intergovernmental) May 4 meeting - Pilgrim NPS license renewal [List for Old Colony meeting]. (ADAMS Accession No. ML063470319)
April 12, 2006	Email: (Intergovernmental) May 3 meeting - Pilgrim NPS license renewal [List for Kingston Meeting]. (ADAMS Accession No. ML063470324)
April 12, 2006	Email: (Intergovernmental) May 3 meeting - Pilgrim NPS license renewal [List for Duxbury meeting]. (ADAMS Accession No. ML063470326)
April 18, 2006	Email: (PD) Pilgrim Nuclear Generating Station License Renewal Application. (ADAMS Accession No. ML063460545)
April 21, 2006	Letter from NRC to J. McGinnis, Request for Comments - Regarding the Pilgrim Nuclear Power Station License Renewal Application Review. (ADAMS Accession No. ML061160613)
April 21, 2006	Letter from NRC to S. M. Thomas, Request for Comments - Regarding the Pilgrim Nuclear Power Station License Renewal Application Review. (ADAMS Accession No. ML061170085)
April 21, 2006	Letter from NRC to M. Bowland, Request for Comments - Regarding the Pilgrim Nuclear Power Station License Renewal Application Review. (ADAMS Accession No. ML061170222)
April 21, 2006	Letter from NRC to C. Andrews-Maltais, Request for Comments - Regarding the Pilgrim Nuclear Power Station License Renewal Application Review. (ADAMS Accession No. ML061170152)
April 24, 2006	NRC Request for Additional Information - Regarding Unresolved Inspection Item 05000293-05-003-01 From the NRC Integrated Inspection Report 05000293-05-003 (TAC No. MD0178). (ADAMS Accession No. ML060970397)
April 24, 2006	Email: (PA) PNPS AMP Questions (ADAMS Accession No. ML062120415)
April 26, 2006	License Renewal Audit and Review Plan for Plant Aging Management Review and Programs for the Pilgrim Nuclear Power Plant, Docket Number 50-293. (ADAMS Accession No. ML061220630)

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Date	**Subject**
April 27, 2006	Email: (PA) PNPS LRA Appendix C - BWRVIP Actions (ADAMS Accession No. ML062090546)
April 28, 2006	Email: (Intergovernmental) May 3 meeting - Pilgrim NPS license renewal [List for Marshfield meeting]. (ADAMS Accession No. ML063470333)
April 28, 2006	NRC Contract Report - Arrange meeting with Town personnel during Site Audit in May (Intergovernmental). (ADAMS Accession No. ML063470170)
April 28, 2006	Email: (PA) Pilgrim Questions to be Discussed at the Audit (ADAMS Accession No. ML062090499)
May 2, 2006	Letter from NRC to Don L. Klima - Regarding Pilgrim Nuclear Power Station License Renewal Application Review. (ADAMS Accession No. ML061240335)
May 4, 2006	Email: (PA) Re: Re-assignment of Tables 3.3.2.14-X (ADAMS Accession No. ML062090497)
May 4, 2006	Email: (PA) AMP questions (ADAMS Accession No. ML062090488)
May 4, 2006	Email: (PA) PNPS Template for not consistent with GALL AMRs (ADAMS Accession No. ML062090496)
May 4, 2006	Email: (PA) Re: Re-assignment of Tables 3.3.2.14-X (ADAMS Accession No. ML062120647)
May 5, 2006	Email: (PA) AMR Template for Not Consistent with GALL Section (ADAMS Accession No. ML062090322)
May 5, 2006	Email: (PA) Re: PNPS Template for not consistent with GALL AMRs (ADAMS Accession No. ML062090493)
May 5, 2006	Email: (PA) Re: Bolting Integrity Program (ADAMS Accession No. ML062090498)
May 5, 2006	Email: (PA) Re: Bolting Integrity Program (ADAMS Accession No. ML062090490)
May 8, 2006	Email: (PA) AMR's Questionary for Pilgrim (ADAMS Accession No. ML062090324)
May 9, 2006	Email: (PA) AMR Review of Section 3.3 (ADAMS Accession No. ML062090328)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
May 10, 2006	Email: (PA) Draft Questions for the Aging Management Program (AMP) Gall Consistency Audit - for Pilgrim. (ADAMS Accession No. ML062480272)
May 10, 2006	Email: Draft questions for the Aging Management Program (AMP) Gall consistency audit - for Pilgrim LRA. (ADAMS Accession No. ML063070393)
May 10, 2006	Email: (PA) FWD: Pilgrim AMP Combined Questions (ADAMS Accession No. ML062480283)
May 10, 2006	Email: Guidance How to File Petition for Intervention with NRC - Pilgrim LRA. (ADAMS Accession No. ML063070187)
May 11, 2006	Letter from Entergy to NRC, Pilgrim Nuclear Power Station, License Renewal Application, Amendment 1. (ADAMS Accession No. ML061380549)
May 11, 2006	Email: (PA) Table 3.3.1 AMR questions (ADAMS Accession No. ML062090333)
May 11, 2006	Email: Pilgrim Letter 2.06.040 - License Renewal Application, Amendment 1. (ADAMS Accession No. ML063070402)
May 11, 2006	Pilgrim Nuclear Power Station License Renewal Application Review (SHPO No. RC36661) (ADAMS Accession No. ML061310234)
May 12, 2006	Email: Guidance how to file petition for intervention with NRC - Pilgrim LRA. (ADAMS Accession No. ML063070405)
May 12, 2006	PNPS License Scoping Comment - Tom Belcher. (ADAMS Accession No. ML062410406)
May 15, 2006	Transmittal Letter for License Renewal Audit and Review Plan for Plant Management Reviews and Programs for the Pilgrim Nuclear Power Plant Docket 50-293. (ADAMS Accession No. ML061220716)
May 17, 2006	Official Transcript, Afternoon, Public Scoping Meeting for Pilgrim, 05/17/2006. (ADAMS Accession No. ML061700046)
May 17, 2006	Pilgrim Nuclear Power Station Environmental Scoping Meeting Handouts. (ADAMS Accession No. ML061420164)
May 17, 2006	Official Transcript, Evening, Public Scoping Meeting for Pilgrim, 05/17/2006. (ADAMS Accession No. ML061700050)
May 19, 2006	Email: (PA-LR) Information re: Pilgrim LRA. (ADAMS Accession No. ML063060296)

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Date	**Subject**
May 19, 2006	Email: (PD) Information re: Pilgrim LRA. (ADAMS Accession No. ML063460507)
May 24, 2006	Letter from Dr. Dean, ACHP to DLR to address license renewal application for Pilgrim. (ADAMS Accession No. ML061710601)
May 25, 2006	Letter from Pilgrim Watch to NRC, Request for a Hearing and Petition to Intervene. (ADAMS Accession No. ML061630125)
May 26, 2006	Massachusetts Attorney General's Request for a Hearing and Petition for Leave to Intervene with Respect to Entergy Nuclear Operations Inc.'s Application for Renewal of the Pilgrim Nuclear Power Plant Operating License (ADAMS Accession No. ML061630088)
May 28, 2006	Email: (PA) Questions for NRC About the Reactor Head Closure Studs AMP (XI.M3) as described in the GALL Report (ADAMS Accession No. ML062090338)
May 30, 2006	Letter from Diane Curran submitting the originals of several documents for which copies of faxed signature pages were filed on May 26, 2006 in connection with the Massachusetts Attorney General's hearing request and backfit petition (ADAMS Accession No. ML061640031)
June 2, 2006	Email: (PA-LR) FW: Word Document of NRC LRA Programs Audit of Pilgrim. (ADAMS Accession No. ML063050504)
June 5, 2006	Notice of Adoption of Contention by Pilgrim Watch. (ADAMS Accession No. ML061720384)
June 6, 2006	Hearing Referral Memorandum from A. Vietti-Cook to P. Bollwerk, ASLBP. (ADAMS Accession No. ML061600221)
June 7, 2006	Establishment of Atomic Safety and Licensing Board (ADAMS Accession No. ML061590519)
June 7, 2006	License Renewal Application, Amendment 2. (ADAMS Accession No. ML061710422)
June 8, 2006	Email: FWD: LRA Amendment 2 (Updated Drywell Shell Information). (ADAMS Accession No. ML063070330)
June 9, 2006	Email: The second set of AMR Questions. (ADAMS Accession No. ML063070327)
June 9, 2006	Email: (PA-LR) Another Round of AMR Questions and TLAA Questions. (ADAMS Accession No. ML063050512)
June 14, 2006	LB Order - Regarding Schedule and Guidance for Proceedings (ADAMS Accession No. ML061660047)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
June 14, 2006	Entergy Response to NRC Request for Additional Information - Regarding Technical Specification Changes to Revise Reactor Coolant Leakage Detection System Instrumentation. (ADAMS Accession No. ML061720084)
June 15, 2006	Notices of Appearance for Susan L. Uttal and Harry E. Wedewer (ADAMS Accession No. ML061670059)
June 15, 2006	NRC Staff Answer to Notice of Adoption of Contentions by Pilgrim Watch (ADAMS Accession No. ML061670039)
June 16, 2006	Request of the Town of Plymouth to Participate as of Right Under 2.315(c). (ADAMS Accession No. ML061740346)
June 16, 2006	Letter from D. Curran to Judge Young providing recent decision by U.S. Court of Appeals for the Ninth Circuit. (ADAMS Accession No. ML061740349)
June 16, 2006	Unopposed Motion for Extension of Time to Reply to NRC Staff Response to Hearing Request, filed by D. Curran, Counsel for Massachusetts Attorney General. (ADAMS Accession No. ML061780634)
June 16, 2006	Unopposed Motion for Extension of Time to Reply to NRC Staff Response to Hearing Request. (ADAMS Accession No. ML061810395)
June 16, 2006	Email from S. Hollis to Judge Young re: Participation in Pilgrim Proceeding and Notice of Appearance. (ADAMS Accession No. ML061780125)
June 16, 2006	Letter from S. S. Hollis to NRC, re Pilgrim Power Station - Regarding Renewal of Facility Operating License DPR-35 for a 20 Year Period. (ADAMS Accession No. ML061770043)
June 19, 2006	NRC Staff's Response to Request for Hearing and Petition to Intervene Filed by Pilgrim Watch (ADAMS Accession No. ML061710086)
June 20, 2006	Official Transcript of Pilgrim Nuclear Power Station Pre-Hearing Conference. (ADAMS Accession No. ML061740366)
June 21, 2006	Email: (PA) Additional Missing AMPs (ADAMS Accession No. ML062510359)
June 21, 2006	LB Order and Notice - Regarding Oral Argument and Limited Appearance Statement Sessions (ADAMS Accession No. ML061720397)
June 22, 2006	Email: (PA) Additional missing AMPs (ADAMS Accession No. ML062510295)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
June 22, 2006	Entergy's Answer to Massachusetts Attorney General's Request for a Hearing, Petition for Leave to Intervene, and Petition for Backfit Order. (ADAMS Accession No. ML061790134)
June 22, 2006	Email: (PA) Additional Missing AMPs (ADAMS Accession No. ML062510361)
June 22, 2006	NRC Staff Answer Opposing Massachusetts Attorney General's Request for Hearing and Petition for Leave to Intervene and Petition for Backfit Order (ADAMS Accession No. ML061730482)
June 23, 2006	NRC Press Release-I-06-038: Licensing Board to Hear Oral Arguments and Receive Public Comment in Pilgrim License Renewal Proceeding. (ADAMS Accession No. ML061740031)
June 25, 2006	Email: (PA) Additional AMR Question - Section 3.1.1 (ADAMS Accession No. ML062120410)
June 26, 2006	Entergy's Answer to the Request for Hearing and Petition to Intervene by Pilgrim Watch and Notice of Adoption of Contention. (ADAMS Accession No. ML061840216)
June 26, 2006	Email from R. Chin, Duxbury Nuclear Advisory Committee to Judge Young re: Limited Appearance Statements (ADAMS Accession No. ML061780159)
June 26, 2006	Email: (PA) Audit Report Attachment 5 - List of Documents (ADAMS Accession No. ML062130145)
June 26, 2006	Email: (PA) Schedule (ADAMS Accession No. ML062120408)
June 26, 2006	Email: (PA-LR) Draft Qs on Section 2.3 on Pilgrim LRA Staff Request a Phone Call on June 27, 2006. (ADAMS Accession No. ML063050509)
June 27, 2006	Email: (PA) PNPS Response for AMR Items 460 and 512 - Potential Conflict in the Responses (ADAMS Accession No. ML062090388)
June 27, 2006	Email: (PA) PNPS Response for AMR Items 460 and 512 - Potential Conflict in the Responses (ADAMS Accession No. ML062120407)
June 27, 2006	Email: (PA-LR) Fwd: PNPS Response for AMR Items 460 and 512 - Potential Conflict in the Responses. (ADAMS Accession No. ML063050396)
June 29, 2006	Email: (PA-LR) Additional Questions From Bob Jackson (ADAMS Accession No. ML063050603)
June 29, 2006	Email: (PA) PNPS Shell (ADAMS Accession No. ML062090319)

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Date	**Subject**
June 29, 2006	Email: (PA) Jim and Peter (ADAMS Accession No. ML062090309)
June 29, 2006	Email: (PA) Nonsafety-Related SCs (ADAMS Accession No. ML062130056)
June 29, 2006	Email: (PA) Additional Question from Bob Jackson (ADAMS Accession No. ML062130057)
June 29, 2006	Email: (PA) Re: QA for Aging Management of NSR Components (ADAMS Accession No. ML062130058)
June 29, 2006	Email: (PA) Re: QA for Aging Management of NSR Components (ADAMS Accession No. ML062090569)
June 29, 2006	Pilgrim - Massachusetts's Attorney General's Reply to Entergy's and NRC Staff's Responses to Hearing Request and Petition to Intervene. (ADAMS Accession No. ML061870225)
June 29, 2006	Email: (PA) - None - (ADAMS Accession No. ML062120406)
June 29, 2006	Email: (PA) Re: QA for Aging Management of NSR Components (ADAMS Accession No. ML062090318)
June 29, 2006	Email: (PA-LR) Nonsafety-Related SCs. (ADAMS Accession No. ML063050610)
June 30, 2006	Email: (PA) FWD: Questions and Answers of Pilgrim LRA Aging Management Reviews. (ADAMS Accession No. ML062480379)
June 30, 2006	Notice of Forthcoming Exit Meeting with Entergy Nuclear Operations, Inc., on License Renewal Scoping and Screening Methodology and the Aging Management Program / Aging Management Review Audits for Pilgrim Nuclear Power Station. (ADAMS Accession No. ML061810424)
June 30, 2006	Email: (PA:) FWD: Questions and Answers of Pilgrim LRA Aging Management Reviews (ADAMS Accession No. ML062130018)
June 30, 2006	Email: (PA) Draft AMP Section of Audit Report (ADAMS Accession No. ML062510364)
June 30, 2006	Email: (PA) Response to ARM Questions 482 & 483 (ADAMS Accession No. ML062090567)
June 30, 2006	Email: (PA) Response to ARM Questions 482 and 483 (ADAMS Accession No. ML062090380)
June 30, 2006	Email: (PA) Draft AMP Section of Audit Report (ADAMS Accession No. ML062120423)

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Date	**Subject**
June 30, 2006	Email: (PA) Questions and Answers of Pilgrim LRA Aging Management Reviews. (ADAMS Accession No. ML062480297)
June 30, 2006	Email: (PA-LR) Questions and Answers of Pilgrim LRA Aging Management Reviews. (ADAMS Accession No. ML063050613)
July 3, 2006	Pilgrim Watch Reply to NRC's and Entergy's Answers to Notice of Adoption of Contention by Pilgrim Watch. (ADAMS Accession No. ML062160441)
July 3, 2006	Email: (PA) Re: QA for Aging Management of NSR Components (ADAMS Accession No. ML062090565)
July 3, 2006	Email: (PA) Re: QA for Aging Management of NSR Components (ADAMS Accession No. ML062090307)
July 3, 2006	Pilgrim Watch Reply to Entergy Answer to Request for Hearing and Petition to Intervene by Pilgrim Watch. (ADAMS Accession No. ML062160449)
July 5, 2006	Email: (PA) Re: Draft AMP Section of Audit Report (ADAMS Accession No. ML062090303)
July 5, 2006	Email: (PA) FW: Handing of Generic Issues (ADAMS Accession No. ML062130091)
July 5, 2006	Email: (PA) Quality Assurance for Aging Management of NSR Components (ADAMS Accession No. ML062090304)
July 5, 2006	Email: (PA) Re: Draft AMP Section of Audit report (ADAMS Accession No. ML062130089)
July 5, 2006	Email: (PA) Re: FW: Handling of Generic Issues (ADAMS Accession No. ML062090300)
July 5, 2006	Email: (PA) Re: Quality Assurance for aging management of NSR components (ADAMS Accession No. ML062130064)
July 5, 2006	Pilgrim - License Renewal Application Amendment 3. (ADAMS Accession No. ML061940175)
July 5, 2006	Pilgrim - License Renewal Application Amendment 4. (ADAMS Accession No. ML061930418)
July 5, 2006	Email: (PA) FYI: Draft Audit Report Shell TLAA on Metal Fatigue - Audit Report Section 4.3 (ADAMS Accession No. ML062090297)
July 5, 2006	Email: (PA) PNPS's TLAA Section 4.6 (ADAMS Accession No. ML062090563)

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Date	Subject
July 5, 2006	Email: (PA) Quality Asurance for Aging Management of NSR Components (ADAMS Accession No. ML062090561)
July 5, 2006	Email: (PA) PNPS's TLAA Section 4.6 (ADAMS Accession No. ML062090305)
July 5, 2006	Email: (PA) Re: Quality Assurance for aging management of NSR components (ADAMS Accession No. ML062130054)
July 5, 2006	Email: (PA) Comments on the AMP writeup (ADAMS Accession No. ML062130053)
July 5, 2006	Email: (PA) Re: Quality Assurance for Aging Management of NSR Components (ADAMS Accession No. ML062090294)
July 6, 2006	Official Transcript of Limited Appearance Comment Session in the Pilgrim Nuclear Power Station License Renewal Proceeding. (ADAMS Accession No. ML061930218)
July 6, 2006	Email: (PA-LR) FW: PNPS ER EJ writeup. (ADAMS Accession No. ML063060309)
July 6, 2006	Email: (PA) Re: Quality Assurance for Aging Management of NSR Components. (ADAMS Accession No. ML062120477)
July 6, 2006	Email: (PA) Re: Quality Assurance for aging management of NSR components (ADAMS Accession No. ML062130140)
July 6, 2006	Email: (PA) FYI: Draft Audit Report Shell TLAA on Metal Fatigue - Audit Report Section 4.3 (ADAMS Accession No. ML062130086)
July 6, 2006	Email: (PA) Additional AMR questions (ADAMS Accession No. ML062130061)
July 6, 2006	Official Transcript of Oral Arguments on Contentions for the Pilgrim Nuclear Power Station License Renewal Proceeding. (ADAMS Accession No. ML061940179)
July 7, 2006	Email: (PA) Re: Comments on Pilgrim AMP document (ADAMS Accession No. ML062120412)
July 7, 2006	Pilgrim - Limited Appearance Statement by Maurice C. Cion. (ADAMS Accession No. ML062070067)
July 7, 2006	Email: (PA) Re: Comments on Pilgrim AMP Document (ADAMS Accession No. ML062090293)
July 7, 2006	Email: (PA) Re: Comments on Pilgrim AMP Document (ADAMS Accession No. ML062130142)

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Date	**Subject**
July 7, 2006	Limited Appearance Statement by W. Bramhall (ADAMS Accession No. ML062060607)
July 7, 2006	Official Transcript of Oral Arguments on Contentions in the Pilgrim Nuclear Power Station License Renewal Proceeding. (ADAMS Accession No. ML061930390)
July 7, 2006	Email: (PA) Comments on Pilgrim AMP document (ADAMS Accession No. ML062120480)
July 10, 2006	Pilgrim - Email from Diane Curran to ASLBP and Parties. (ADAMS Accession No. ML062070055)
July 10, 2006	Email: FWD: Response to your question - Regarding Radwaste Piping. (ADAMS Accession No. ML063070319)
July 11, 2006	Letter from CZM to S. Bethay - Regarding Federal Consistency Review of the Pilgrim Nuclear Power Station Operating License Renewal; Plymouth. (ADAMS Accession No. ML062090362)
July 12, 2006	Email from Susan Uttal to ASLBP and Parties. (ADAMS Accession No. ML062070131)
July 12, 2006	Email: FWD: Pilgrim License Renewal Application Amendment 3 Cover Letter and Attachment A. (ADAMS Accession No. ML063070536)
July 13, 2006	Summary of Public Scoping Meetings Conducted Related to the Review of the Pilgrim Nuclear Power Station, License Renewal Application. (ADAMS Accession No. ML061700055)
July 13, 2006	Letter to the Administrative Judges from Counsel for Entergy following up on one of the two matters raised at last week's prehearing conference. (ADAMS Accession No. ML062020235)
July 13, 2006	Limited Appearance Statement of John R. Glover. (ADAMS Accession No. ML062070224)
July 13, 2006	NRC Press Release-I-06-040: NRC To Meet With Entergy On July 19th To Discuss Pilgrim License Renewal Audit Findings. (ADAMS Accession No. ML061940368)
July 13, 2006	Email: NRC to Discuss Pilgrim Audit Findings. (ADAMS Accession No. ML063070249)
July 14, 2006	LB Order - Regarding Need for Further Briefing on Definition of New ans Significant Information As Addressed in Participants' Petitions, Answers and Replies Relating to Massachusetts Attorney General contention and Pilgrim Watch Contention 4:. (ADAMS Accession No. ML061950481)

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Date	**Subject**
July 14, 2006	Email from Judge Young to the parties. (ADAMS Accession No. ML062060614)
July 14, 2006	Email to Judge Young from Molly Bartlett (ADAMS Accession No. ML062060616)
July 17, 2006	Email: Core shroud tie rod upper support cracking- information request. (ADAMS Accession No. ML063070252)
July 17, 2006	Limited Appearance Statement on Behalf of Clean Water Action (MASSPIRG). (ADAMS Accession No. ML062070051)
July 17, 2006	Email: (PA-LR) Re: Pilgrim [from Lampert to A. Williamson 7/17/06]. (ADAMS Accession No. ML063060259)
July 17, 2006	Email: (PA-LR) Re: Pilgrim. (ADAMS Accession No. ML063060249)
July 17, 2006	Email: (PA-LR) Additional info for ER. (ADAMS Accession No. ML063060239)
July 19, 2006	Pilgrim Nuclear Power Station - License Renewal Application Amendment 5. (ADAMS Accession No. ML062080142)
July 19, 2006	Pilgrim - License Renewal Application Amendment 5. (ADAMS Accession No. ML062090075)
July 20, 2006	Letter on behalf of more than two dozen organizations and individuals listed on draft Director's Decision - Regarding groundwater contamination petition. (ADAMS Accession No. ML062190445)
July 20, 2006	Letter from Entergy to NRC - Regarding follow up information from the prehearing conference on Pilgrim's aging management review to ASLBP. (ADAMS Accession No. ML062120018)
July 21, 2006	Entergy's Brief on New and Significant Information in Response to Licensing Board Order of July 14, 2006. (ADAMS Accession No. ML062080589)
July 21, 2006	NRC Staff's Response to July 14, 2006 Licensing Board Order (ADAMS Accession No. ML062020795)
July 21, 2006	Massachusetts Attorney General's Brief - Regarding Relevance to this Proceeding of Regulatory Guide's Definition of "New and Significant Information." (ADAMS Accession No. ML062080171)
July 21, 2006	Email: (PA) Fwd: Re: RAI for Section 3.5 (ADAMS Accession No. ML062090383)

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Date	**Subject**
July 23, 2006	Pilgrim - Email to Judge Young from Molly Bartlett (ADAMS Accession No. ML062060617)
July 24, 2006	Email: (PA) Re: Any Correspondences from PNPS on LRA Changes. (ADAMS Accession No. ML062090387)
July 24, 2006	Email: FW: Pilgrim LRA Amendment 5. (ADAMS Accession No. ML063070318)
July 25, 2006	Email: (PA) Piligrim AMP/AMR Audit Report (ADAMS Accession No. ML062510296)
July 25, 2006	Email: (PA) Re: FWD: FYI: Forwarding What We Want DCI/FEB to Work at for the Pilgrim Flaw Growth Analysis. (ADAMS Accession No. ML062480362)
July 25, 2006	NRC Request for Additional Information, Pilgrim Nuclear Power Station License Renewal Application (TAC MC9669). (ADAMS Accession No. ML062070240)
July 26, 2006	NRC Request for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application (TAC No. MC9669). (ADAMS Accession No. ML062120464)
July 26, 2006	Email: Request for Additional information on LRA Section 2.1 Scoping and Screening. (ADAMS Accession No. ML063070241)
July 26, 2006	Letter from Entergy to NRC informing that Entergy has already fully addressed the points raised in the Massachusetts Attorney General's brief - Regarding new and significant information. (ADAMS Accession No. ML062130443)
July 26, 2006	Massachusetts Attorney General's Reply Brief - Regarding Relevance to This Proceeding of Regulatory Guide's Definition of "New and Significant Information." (ADAMS Accession No. ML062130446)
July 26, 2006	Email: (PA) Revised AMR 3.4 Input (ADAMS Accession No. ML062480388)
July 27, 2006	Email: Pilgrim - Judge Nicholas Trikouros disclosure statement. (ADAMS Accession No. ML062120730)
July 27, 2006	Email: (PA) PNPS Q&A (ADAMS Accession No. ML062510355)
July 27, 2006	Email: Pilgrim Nuclear Power Station Hearing Files Information Request (7/1/06-7/31/06). (ADAMS Accession No. ML063070245)

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Date	**Subject**
July 27, 2006	*Official Transcript of Entergy Nuclear Generation Company Oral* Arguments via Telephone Conference. (ADAMS Accession No. ML062130024)
July 27, 2006	Email: Fwd: FYI: Attaching File with my Assessment Tracking the Status of Our Metal Fatigue Questions - Jim. (ADAMS Accession No. ML063070246)
July 27, 2006	Email: (PA) PNPS Q&Q (ADAMS Accession No. ML062510306)
July 31, 2006	NRC Requests for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application. (ADAMS Accession No. ML062120662)
July 31, 2006	NRC Requests for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application. (ADAMS Accession No. ML062120743)
July 31, 2006	NRC Requests for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application. (ADAMS Accession No. ML062120752)
July 31, 2006	Email: (PA) Urgent - Revised Section 3.0.4 Input for QA program (ADAMS Accession No. ML062510299)
July 31, 2006	Email: (PA) Updated Section 4.3, Metal Fatigue for PNPS LRA (ADAMS Accession No. ML062510302)
July 31, 2006	NRC Requests for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application. (ADAMS Accession No. ML061940015)
July 31, 2006	Email: Fwd: PNPS Q&A Data Base. (ADAMS Accession No. ML063070232)
August 2, 2006	FAX: From: R. Subbaratnam To: B. Ford/ F. Mogolesko 8/02/2006 RE: Supplement 3. (ADAMS Accession No. ML063070332)
August 2, 2006	Email: (PA) AMR Audit Report Section 3.3 (ADAMS Accession No. ML062480391)
August 2, 2006	FAX: From: R. Subbaratnam to Brian Ford/Fred Mogolesko. ADAMS Accession No. ML062510324)
August 2, 2006	Email: (PA) Email to James Davis from Duc Nguyen on 08/02/2006 at 3:50 4:43 pm (No Subject) (ADAMS Accession No. ML062480361)
August 3, 2006	Email: (PA) FYI: Forwarding Attachment 1 & Attachments 3-7 on Audit Report TLAA Sections. (ADAMS Accession No. ML062480383)

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Date	**Subject**
August 3, 2006	Email: (PA) TLAA Input (ADAMS Accession No. ML062480381)
August 3, 2006	Email: (PA) TLAA Section 4.3 Input (ADAMS Accession No. ML062480395)
August 3, 2006	Email: Fwd: Pilgrim ASLB Hearing: from Ram Subbaratnam 8/3/06 10:55am. (ADAMS Accession No. ML063070234)
August 3, 2006	Email: Fwd: Pilgrim ASLB Hearing. (ADAMS Accession No. ML063070236)
August 3, 2006	Email: (PA) Duc's Audit and Review Report Input (ADAMS Accession No. ML062480385)
August 4, 2006	Motion on Behalf of Pilgrim Watch for Disqualification of Judge Nicholas Trikouros. (ADAMS Accession No. ML062500138)
August 4, 2006	Massachusetts Attorney General's Motion for Disqualification of Judge Nicholas Trikouros. (ADAMS Accession No. ML062210100)
August 7, 2006	Email Re: RAM: From Fred Mogolesko 8/7/06 12:01pm. (ADAMS Accession No. ML063070219)
August 7, 2006	Email: FW: RAM. (ADAMS Accession No. ML063070220)
August 7, 2006	Email: Fwd: RAM: from Ram Sabbaratnam 8/7/06 9:13am. (ADAMS Accession No. ML063070239)
August 9, 2006	Notice of Appearance for Marian L. Zobler (Pilgrim Nuclear Power Plant) and Certificate of Service (ADAMS Accession No. ML062210250)
August 10, 2006	Email: FW: Requested Pilgrim Isl Information. (ADAMS Accession No. ML063070222)
August 10, 2006	Email: FW: Requested Information from Pilgrim License Renewal Program Document PRPD-06. (ADAMS Accession No. ML063070225)
August 11, 2006	Email: Draft RAIs on Section 2.4 of Pilgrim LRA. (ADAMS Accession No. ML063070228)
August 11, 2006	Email: (PA) RAI for the Three Flaw Issues for the Pilgrim LRA (ADAMS Accession No. ML062510343)
August 14, 2006	NRC Requests for Additional Information For the Review of the Pilgrim Nuclear Power Station License Renewal Application (TAC MC9669). (ADAMS Accession No. ML062290474)
August 14, 2006	Email: (PA) LRA B.1.1, Boraflex Program (ADAMS Accession No. ML062510350)

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Date	**Subject**
August 14, 2006	Email: (PA) RAIs 3.5.1-1 and 3.5.1-2 (ADAMS Accession No. ML062510346)
August 14, 2006	Entergy's Response to Motions for Disqualification of Judge Nicholas Trikouros. (ADAMS Accession No. ML062340098)
August 15, 2006	Summary of Public Audit Status Briefing with Entergy Nuclear Operations, Inc., on License Renewal Scoping and Screening Methodology and the Aging Management Program and the Aging Management Review Audits for the Pilgrim Nuclear Power Station. (ADAMS Accession No. ML062280218)
August 16, 2006	Email: (NPA-PD-LR) RAI on Chapter 4.0 TLAAs (from Ram Subbaratnam). (ADAMS Accession No. ML063040463)
August 16, 2006	Updated Schedule of Submittal of License Renewal Applications for Entergy Plants. (ADAMS Accession No. ML062330008)
August 18, 2006	Email: Formal RAIs for Pilgrim License Renewal Application on Sections 3.5 & 3.6. (ADAMS Accession No. ML063070230)
August 21, 2006	Email: Additional draft (draft RAIs) the audit team requests (August 21, 2006). (ADAMS Accession No. ML063070188)
August 21, 2006	Email: (NPA-PD-LR) RAIs from Audit by Danhoang & Erach. (ADAMS Accession No. ML062990442)
August 21, 2006	Email: (NPA-PD-LR) Requested RAI on Pilgrim LRA. (ADAMS Accession No. ML062990253)
August 22, 2006	NRC Requests for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application (TAC MC9669). (ADAMS Accession No. ML062350440)
August 22, 2006	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 6. (ADAMS Accession No. ML062420060)
August 23, 2006	Email: Questions From Fred Mogolesko 8/23/2006 9:29am. (ADAMS Accession No. ML063070190)
August 23, 2006	Email: (NPA-PD-LR) Fwd: FW: Pilgrim License Renewal Application Amendment 6 (RAI Responses from Entergy on Pilgrim LRA). (ADAMS Accession No. ML063050296)
August 23, 2006	Email: FW: Pilgrim License Renewal Application Amendment 6. (ADAMS Accession No. ML063070217)
August 25, 2006	Email: (NPA-PD-LR) Final RAI on Section 2.4 - Scoping and Screening Structures for the Pilgrim LRA. (ADAMS Accession No. ML062980322)

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Date	**Subject**
August 25, 2006	Summary of August 1, 2006 Telephone Conference with Entergy Nuclear Operations, Inc. (ADAMS Accession No. ML062410379)
August 25, 2006	Letter from D. Curran to NRC - Regarding Petition for Rulemaking PRM 50-10 to Amend 10 C.F.R. Part 51, on behalf of the Massachusetts Attorney General. (ADAMS Accession No. ML062640409)
August 25, 2006	Email: (PA) Pilgrim Audit Report Peer Review AMP Sections (ADAMS Accession No. ML062510307)
August 28, 2006	Email: Preparation for Region 1 Inspection at Pilgrim: from: Fred Mogolesko 8/28/06 10:17 am. (ADAMS Accession No. ML063070367)
August 28, 2006	Email: Meeting Summary for your information: from Ram Subbaratnam 8/28/06 9:18am. (ADAMS Accession No. ML063070375)
August 28, 2006	Email: Draft Pilgrim RAIs on Section 4.2.1 - TLAAs on RV Internals, Neutron Fluence. (ADAMS Accession No. ML063070361)
August 30, 2006	Letter from D. R. Lewis of Pillsbury, Winthrop, Shaw and Pittman to NRC - Regarding Massachusetts Attorney General's Petition for Rulemaking PRM-51-10 to Amend 10 CFR Part 51 (August 25, 2006). (ADAMS Accession No. ML062650221)
August 30, 2006	Email: (PA) SER Input. (ADAMS Accession No. ML062980258)
August 30, 2006	LB Notice of Reconstitution (ADAMS Accession No. ML062420469)
August 30, 2006	LB Notice of Recusal of Judge Nicholas Trikouros (ADAMS Accession No. ML062420487)
August 30, 2006	Letter from Entergy to NRC - Regarding Entergy's Response to Massachusetts Attorney General's Petition for Rulemaking to Amend 10 C.F.R. Part 51 (Aug. 25, 2006). (ADAMS Accession No. ML062480366)
August 30, 2006	Entergy Response to Requests for Additional Information re License Renewal Application Amendment 7. (ADAMS Accession No. ML062500117)
August 31, 2006	Email: (Intergovernmental) Pilgrim NPS EIS - info request. (ADAMS Accession No. ML063470471)
September 1, 2006	Email: (Intergovernmental) Re: Pilgrim NPS EIS - info request. (ADAMS Accession No. ML063470473)
September 5, 2006	Email: (NPA-PD-LR) Pilgrim LRA - RAI Responses from Entergy (NRC-03-03-038, Task Order 24). (ADAMS Accession No. ML063110209)

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Date	**Subject**
September 7, 2006	NRC Request for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application (TAC No. MC9669). (ADAMS Accession No. ML062490501)
September 7, 2006	Email: Final RAI on Pilgrim LRA Section 4.3.2.1. (ADAMS Accession No. ML063060595)
September 8, 2006	Email: (Intergovernmental) Re: Plymouth Population & Buildout Data. (ADAMS Accession No. ML063470479)
September 8, 2006	NRC Request for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application (TAC MC9669) Section 3.2. (ADAMS Accession No. ML062500431)
September 8, 2006	NRC Requests for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application (TAC MC9669). (ADAMS Accession No. ML062500401)
September 8, 2006	Email: (NPA-PD-LR) Fwd: Final RAI on Pilgrim LRA Sections 3.2.1 and 4.2.1. (ADAMS Accession No. ML062990446)
September 13, 2006	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 8. (ADAMS Accession No. ML062650072)
September 13, 2006	Email: Entergy Memo of 9/13/2006 - Pilgrim. (ADAMS Accession No. ML063070420)
September 15, 2006	Memorandum (Signed by B. Rogers) to P.T. Kuo, NRC, Audit Trip Report - Regarding Entergy Nuclear Operations Inc. License Renewal Application for Pilgrim Nuclear Power Station, dated January 25, 2006. (ADAMS Accession No. ML062580162)
September 26, 2006	LB Memorandum (Notice of Expected Date for Decision) (ADAMS Accession No. ML062690345)
October 3, 2006	Email: (PA-LR) Information from the Conference call on 9/26/06. (ADAMS Accession No. ML063050380)
October 6, 2006	Email: (NPA-PD-LR) Fwd: Pilgrim LRA Amendment 9 10/6/2006. (ADAMS Accession No. ML063110171)
October 6, 2006	Letter from Entergy to NRC, Pilgrim License Renewal Application Amend 9, Revised List of Regulatory Commitments & Response to RAIs on Aging Management Review in LRA Section 3.2 Engineered Safety Features &Time Limiting Aging Analysis in LRA Section 4.2 Reactor Vessel.... (ADAMS Accession No. ML062910173)
October 10, 2006	Commission Order (CLI-06-26) (ADAMS Accession No. ML062830327)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
October 16, 2006	Entergy Response to NRC Request for Additional Information Related to Proposed License Amendment to Change P-T Curves (TAC No. MD1218). (ADAMS Accession No. ML062970147)
October 16, 2006	LB Memorandum and Order (Ruling on Standing and Contentions of Petitioners Massachusetts Attorney General and Pilgrim Watch) (LBP-06-23) (ADAMS Accession No. ML062890259)
October 19, 2006	Email: (PA-LR) FW: Figure 2-1. (ADAMS Accession No. ML063050385)
October 19, 2006	Email: (PA-LR) FW: Drawing. (ADAMS Accession No. ML063050392)
October 19, 2006	Email: (PA-LR) FW: Figure 3-1. (ADAMS Accession No. ML063050388)
October 23, 2006	Summary of October 10, 2006 Telephone Conference with Entergy Nuclear Operations. Inc., to Clarify Information Sent to the NRC in Response to Requests for Additional Information - Regarding the Pilgrim License Renewal Application (TAC NO. MC9669). (ADAMS Accession No. ML062850407)
October 23, 2006	Email: (PA-LR) Re: Pilgrim - Amendments to the LRA. (ADAMS Accession No. ML063050501)
October 24, 2006	Email from S. Uttal, OGC requesting to ASLBP Judges to reschedule telephone conference. (ADAMS Accession No. ML063000239)
October 24, 2006	LB Order - Regarding Prehearing Telephone Conference and Schedule for Proceeding (ADAMS Accession No. ML062970412)
October 24, 2006	Email from M. Lampert to ASLBP Judges requesting rescheduling of telephone conference. (ADAMS Accession No. ML063000247)
October 25, 2006	LB Order (Granting Staff Request to Reschedule Telephone Conference) (ADAMS Accession No. ML062980380)
October 26, 2006	Letter from NRC Staff to Administrative Judges - Regarding Entergy Nuclear Operations, Inc. (Pilgrim Nuclear Power Station) (ADAMS Accession No. ML063000300)
October 30, 2006	Letter from NRC Staff to Administrative Judges informing Board and Parties of Estimation dates for SER and SEIS. (ADAMS Accession No. ML063050353)
October 31, 2006	Massachusetts Attorney General's Brief on Appeal of LBP-06-23. (ADAMS Accession No. ML063120343)

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Date	**Subject**
October 31, 2006	Pilgrim Watch Brief on Appeal of LBP-06-23. (ADAMS Accession No. ML063120552)
October 31, 2006	Notice of Appeal of Order LBP-06-23 by Pilgrim Watch. (ADAMS Accession No. ML063120336)
November 1, 2006	Audit and Review Report for Plant Aging Management Reviews and Programs Pilgrim Nuclear Power Station. (ADAMS Accession No. ML063110278)
November 2, 2006	NRC Request for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application (TAC MC9669). (ADAMS Accession No. ML062900231)
November 2, 2006	Email: (PD) Draft RAI. (ADAMS Accession No. ML063480351)
November 3, 2006	Town of Duxbury Request and Notice of Intent to Participate in Hearing. (ADAMS Accession No. ML063170052)
November 6, 2006	Email: (PD) Fwd: Entergy Nuclear Cultural Resources Protection Plan. (ADAMS Accession No. ML063480402)
November 6, 2006	Notice of the Town of Plymouth of Participation in Certain Contentions. (ADAMS Accession No. ML063190311)
November 7, 2006	Summary of September 25, 2006 Telephone Conference with Entergy Nuclear Operations, Inc. (ADAMS Accession No. ML062760508)
November 7, 2006	NRC Request for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application (TAC MC9669) (Section B.1.16.1). (ADAMS Accession No. ML062960274)
November 8, 2006	Email dated from David R. Lewis notifying parties and Board in agreement that set schedule for Model Milestones could be met. (ADAMS Accession No. ML063180264)
November 8, 2006	Email from Judge Young to parties requesting information - Regarding scheduling of upcoming telephone conference. (ADAMS Accession No. ML063240353)
November 10, 2006	Entergy's Opposition to Pilgrim Watch's Appeal of LBP-06-23. (ADAMS Accession No. ML063200503)
November 10, 2006	Entergy's Brief in Opposition to Massachusetts Attorney General's Appeal of LBP-06-23. (ADAMS Accession No. ML063200505)
November 11, 2006	Email: (PA) Request for Additional Information (RAI) - Regarding Severe Accident Mitigation Alternatives (SAMA) for Pilgrim Nuclear Power Station, May 22, 2006. (ADAMS Accession No. ML063450084)

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Date	**Subject**
November 13, 2006	NRC Staff's Brief in Opposition to Massachusetts Attorney General's Petition for Review of LBP-06-23. (ADAMS Accession No. ML063200152)
November 13, 2006	NRC Staff's Brief in Opposition to Pilgrim Watch's Appeal of LBP-06-023. (ADAMS Accession No. ML063200174)
November 14, 2006	Memorandum (Signed by K. Chang) to L. Lund, NRC, Audit and Review Report for the Pilgrim Nuclear Generating Station License Renewal Application (TAC NO. MC7624). (ADAMS Accession No. ML063100404)
November 14, 2006	Joint Stipulation and Motion on Disclosure. (ADAMS Accession No. ML063260461)
November 14, 2006	Email: (PA) Re: Request for Additional Information (RAI) - Regarding Severe Accident Mitigation Alternatives (SAMA). (ADAMS Accession No. ML063450081)
November 15, 2006	NRC Staff Notice of Appearance for David E. Roth. (ADAMS Accession No. ML063200368)
November 15, 2006	Initial Disclosure Statement by Pilgrim Watch. (ADAMS Accession No. ML063310309)
November 15, 2006	Entergy's Initial Disclosures. (ADAMS Accession No. ML063280030)
November 15, 2006	Letter from NRC Staff to Administrative Judges and the parties that the hearing file and mandatory disclosures are available. (ADAMS Accession No. ML063200344)
November 16, 2006	Letter from OGC/Staff to the Administrative Judges notifying them of a new hearing file and providing Affidavit of Perry Buckberg. (ADAMS Accession No. ML063240423)
November 16, 2006	LB ORDER (Administrative Matters - Regarding Telephone Conference) (ADAMS Accession No. ML063200345)
November 17, 2006	Entergy Response to NRC Request for Additional Information - Regarding Emergency Plan Changes to Emergency Response Organization. (ADAMS Accession No. ML063320549)
November 17, 2006	Email: (PD) WP copy of RAI Letter. (ADAMS Accession No. ML063480328)
November 20, 2006	Official Transcript of Entergy Nuclear Operations, Inc. Pre-Hearing Conference. (ADAMS Accession No. ML063280126)

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Date	**Subject**
November 29, 2006	LB ORDER - Regarding Schedule for Proceeding and Related Matters (ADAMS Accession No. ML063330391)
November 30, 2006	Email:(PD) Your Upcoming LR Inspection at Pilgrim. (ADAMS Accession No. ML063460530)
November 30, 2006	Email: (PA) Your Upcoming LR Inspection at Pilgrim. (ADAMS Accession No. ML070120084)
December 1, 2006	Letter from Entergy to the Administrative Judges providing SEI, and SER status. (ADAMS Accession No. ML063350216)
December 4, 2006	Email: (PD) Conference Call Request - From Perry Buckberg to : Doug Ellis 12/04/06 2:25:00 PM. (ADAMS Accession No. ML070100094)
December 4, 2006	Email: (PD) Conference Call Request. (ADAMS Accession No. ML063460517)
December 6, 2006	Email: (PD) Conference Call - 12/12/06 @ 12:30. (ADAMS Accession No. ML063460536)
December 6, 2006	Email: (PD) Conference Call - 12/02/06. (ADAMS Accession No. ML070100101)
December 8, 2006	Notice of Availability of the Draft Plant-Specific Supplement 29 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) - Regarding Pilgrim. (ADAMS Accession No. ML063410493)
December 8, 2006	Email from Molly Bartlett, Esq. For Pilgrim Watch to Judge Young re: scheduling site visit and limited appearance session. (ADAMS Accession No. ML063450162)
December 8, 2006	Email: (PD) PNPS Draft SEIS. (ADAMS Accession No. ML070110583)
December 8, 2006	Notice of Availability of the Draft Plant-Specific Supplement 29 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants - Regarding Pilgrim Nuclear Power Station. (ADAMS Accession No. ML063410331)
December 12, 2006	Letter from Entergy to NRC dated 12 December, 2006 (including attached PNPS MACCS2 Input Files -attached CD) - Regarding License Renewal Application amendment for Pilgrim Station operating license. (ADAMS Accession No. ML070100410)
December 12, 2006	Email from Susan L. Uttal to the Administrative Judges informing that on 12/08/06, the Draft Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 29 (draft SEIS)...was issued (ADAMS Accession No. ML070040079)

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Date	**Subject**
December 13, 2006	Email: (PA) RE: 12/12/2006 Conference Call Record - From: Ellis, Doug To: Perry Buckberg - 12/13/2006 3:14:29 PM. (ADAMS Accession No. ML070100073)
December 13, 2006	Email: (PD) Dec 12 Conference Call Record - From: Perry Buckberg To: Doug Ellis. (ADAMS Accession No. ML070100223)
December 13, 2006	Email: (PD) Pilgrim RAI Follow Up - From: Perry Buckberg To: Doug Ellis - 12/13/2006 2:55:32 PM. (ADAMS Accession No. ML070100239)
December 13, 2006	Email: (PD) 12/12/2006 Conference Call Record - From: Perry Buckberg To: Doug Ellis 2:50:52 PM. (ADAMS Accession No. ML070100228)
December 14, 2006	Federal Register Notice - Entergy Nuclear Operations, Inc. Pilgrim Nuclear Power Station; Notice of Availability of the Draft Supplement 29 to the Generic Environmental Impact Statement for License Renewal of Nuclear Plants and Public Meeting for the... (ADAMS Accession No. ML070330554)
December 18, 2006	Letter from Molly L. Barkman notifying the Administrative Judges with the addendum to the index of Supplement 1 (Accession No. ML063530304)
December 18, 2006	Email: (PD) Conference Call - From: Perry Buckberg To: Doug Ellis; Edwin Forrest - 12/18/2006 12:57:25 PM. (ADAMS Accession No. ML070100272)
December 19, 2006	G20061071/LTR-06-0668 - Mary Lampert Ltr. Re Concerns Pilgrim Nuclear Power Station. (ADAMS Accession No. ML070030207)
December 28, 2006	Letter from S. Uttal to Administrative Judges re: Staff Review Schedule (ADAMS Accession No. ML063630334)
December 29, 2006	Summary of December 12, 2006 Telephone Conference with Entergy Nuclear Operations, Inc., - Regarding Pilgrim Nuclear Power Station License Renewal (ADAMS Accession No. ML063480053)
December 31, 2006	NUREG-1437, Supp 29, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 29 - Regarding Pilgrim Nuclear Power Station," Draft Report. (ADAMS Accession No. ML063260173)
January 4, 2007	Email: (PD) FW: Pilgrim in the News. (ADAMS Accession No. ML070440359)

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Date	**Subject**
January 5, 2007	Letter from NRC to B. Simon - Regarding Pilgrim Nuclear Power Station License Renewal Application Review (SHPO NO. RC 36661). (ADAMS Accession No. ML063480099)
January 10, 2007	Email: (PA) Pilgrim LRA Amendment 11. (ADAMS Accession No. ML070380551)
January 10, 2007	Email: (PA) FW: Pilgrim LRA Amendment 11. (ADAMS Accession No. ML070380577)
January 10, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 11. (ADAMS Accession No. ML070250175)
January 12, 2007	NRC Press Release-I-07-002: NRC to Hold Public Meetings on Draft Environmental Impact Report for Pilgrim Nuclear Plant License Renewal Application. (ADAMS Accession No. ML070120427)
January 16, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 12. (ADAMS Accession No. ML070230286)
January 16, 2007	Email: (PD) Fwd: Documents from Pilgrim. (ADAMS Accession No. ML070370589)
January 17, 2007	Email: (PD) Fwd: Entergy Info on Drywell Liner UT Measurements. (ADAMS Accession No. ML070370587)
January 17, 2007	Email: (PD) Pilgrim LRA Amendment 12. (ADAMS Accession No. ML070380227)
January 17, 2007	Notice of Meeting Between NRC Staff & Entergy Management to Inform Entergy Management of Results of NRC Team Inspection Covering Scoping & Aging Management Portions of Pilgrim Nuclear Power Station Application For A Renewed License. (ADAMS Accession No. ML070170610)
January 17, 2007	Email: (PA) FW: Pilgrim License Renewal Application Amendment 12. (ADAMS Accession No. ML070380549)
January 18, 2007	Summary of December 18, 2006 Telephone Conference with Entergy Nuclear Operations, Inc., - Regarding the Pilgrim License Renewal Application. (ADAMS Accession No. ML063540010)
January 18, 2007	Email: (PD) Fwd: FW: Drawing. (ADAMS Accession No. ML070380092)
January 18, 2007	Email: (PA) FW: Drawing. (ADAMS Accession No. ML070380545)
January 22, 2007	Email: (PD) Drywall Air Gap Foam. (ADAMS Accession No. ML070380088)

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Date	**Subject**
January 23, 2007	NRC Press Release-I-07-004: NRC to Discuss Preliminary Results of License Renewal Inspection for Pilgrim Nuclear Power Plant. (ADAMS Accession No. ML070230491)
January 24, 2007	DSEIS Meeting Presentation, Preliminary Results of Environmental Review Pilgrim Nuclear Power Station. (ADAMS Accession No. ML070330562)
January 26, 2007	Email: (PA) Scan001 (30).pdf. (ADAMS Accession No. ML070440356)
January 29, 2007	Email: (PD) DLR Briefs. (ADAMS Accession No. ML070370295)
January 29, 2007	Email: (PA) PNPS Meeting 1.30.07?. (ADAMS Accession No. ML070380579)
January 29, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 13. (ADAMS Accession No. ML070370413)
January 29, 2007	Email: (PA) FW: Pilgrim LRA Amendment 13. (ADAMS Accession No. ML070380543)
January 30, 2007	Email: (PD) Re: Pilgrim SEIS. (ADAMS Accession No. ML070440402)
January 30, 2007	Email: (PD) Pilgrim LRA Amendment 13. (ADAMS Accession No. ML070370298)
January 30, 2007	Email: (PD) FSAR Excerpt. (ADAMS Accession No. ML070370272)
January 30, 2007	Pilgrim License Renewal Inspection Exit Meeting Slides. (ADAMS Accession No. ML070440323)
January 31, 2007	Email: (PD) Re: Inspection Exit Meeting - Plymouth - 01.30.07. (ADAMS Accession No. ML070370290)
January 31, 2007	Email: (PD) Re: Inspection Exit Meeting - Plymouth - 01.30.07 (from M. Lampert). (ADAMS Accession No. ML070370286)
January 31, 2007	Email: (PD) Pilgrim Follow Up Information. (ADAMS Accession No. ML070440406)
February 1, 2007	Letter from Entergy to Administrative Judges Notifying Them of No Changes in Final SAIS (Pilgrim) (ADAMS Accession No. ML070320201)
February 2, 2007	Letter from NRC to Entergy - Regarding Audit and Review Report for Plant Aging Management Reviews and Programs for the Pilgrim Nuclear Power Station License Renewal Application (TAC MC9669). (ADAMS Accession No. ML063480333)

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Date	**Subject**
February 7, 2007	Email: Error in Pilgrim letter dated 01/04/07 (Pilgrim letter number 2.07.004). (ADAMS Accession No. ML070380424)
February 16, 2007	Summary of January 23, 2007 Telephone Conference with Entergy Nuclear Operations, Inc., - Regarding the Pilgrim License Renewal Application. (ADAMS Accession No. ML070300793)
February 23, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 14. (ADAMS Accession No. ML0706503500)
March 1, 2007	NRC Letter Transmitting the Safety Evaluation Report With Open Items Related to the License Renewal of PNPS (ADAMS Accession No. ML070510236)
March 13, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 15. (ADAMS Accession No. ML070790316)
March 15, 2007	Summary of February 26, 2007 Telephone Conference with Entergy Nuclear Operations, Inc., - Regarding the Pilgrim License Renewal Application. (ADAMS Accession No. ML070600567)
March 26, 2007	NRC Request for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application (TAC MC9669) (Section 4.2). (ADAMS Accession No. ML070780058)
March 28, 2007	Letter from Entergy to NRC - Comments on Draft Safety Evaluation Report, dated March 2007. (ADAMS Accession No. ML071380190)
March 29, 2007	Email: (PD) FW: Entergy-Preliminary Durability Performance Evaluation. (ADAMS Accession No. ML0710203190)
April 4, 2007	Transcript of ACRS Meeting of Plant License Renewal Subcommittee on April 4, 2007 in Rockville, MD. Pages 1 - 193. (Accession No. ML071090564)
April 27, 2007	Summary of April 2, 2007 Telephone Conferences with Entergy Nuclear Operations, Inc., - Regarding the Pilgrim License Renewal Application. (ADAMS Accession No. ML071030053)
April 28, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Annual Update. (ADAMS Accession No. ML071160152)
May 1, 2007	Summary of March 14, 2007 and March 15, 2007 Telephone Conferences with Entergy Nuclear Operations, Inc., - Regarding the Pilgrim License Renewal Application. (ADAMS Accession No. ML071030093
May 1, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 16. (ADAMS Accession No. ML071280251)

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Date	**Subject**
May 17, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 17. (ADAMS Accession No. ML071550310)
June 8, 2007	Summary of May 10, 2007 Telephone Conference with Entergy Nuclear Operations, Inc., - Regarding the Pilgrim License Renewal Application. (ADAMS Accession No. ML071310069)
June 21, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 18. (ADAMS Accession No. ML071730467)
June 28, 2007	NRC Letter Transmitting the Safety Evaluation Report Related to the License Renewal of PNPS (ADAMS Accession No. ML071410036)
July 26, 2007	NRC Request for Additional Information for the Review of the Pilgrim Nuclear Power Station License Renewal Application (TAC MC9669) (Section 4.3.3) (ADAMS Accession No. ML072000407)
July 30, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 19. (ADAMS Accession No. ML072190611)
August 23, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Commitment 47. (ADAMS Accession No. ML072530516)
August 28, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Amendment 20. (ADAMS Accession No. ML072470403)
August 31, 2007	Summary of August 23, 2007 and August 27, 2007 Telephone Conferences with Entergy Nuclear Operations, Inc., - Regarding the Pilgrim License Renewal Application. (ADAMS Accession No. ML072390007)
September 6, 2007	Transcript of ACRS Meeting of Plant License Renewal Subcommittee on September 6, 2007 in Rockville, MD. Pages 1 - 283. (Accession No. ML072560775)
September 7, 2007	Summary of August 30, 2007 Telephone Conference with Entergy Nuclear Operations, Inc., - Regarding the Pilgrim License Renewal Application. (ADAMS Accession No. ML072430264)
September 12, 2007	Letter from Entergy to NRC - Regarding License Renewal Application Commitment 47. (ADAMS Accession No. ML072700723)
September 26, 2007	Report from William Shack, Chairman of the Advisory Committee on Reactor Safeguards, to Dale Klein, Chairman of the NRC on the Safety Aspects of the License Renewal Application for the Pilgrim Nuclear Power Station. (Accession No. ML072530637)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
September 27, 2007	NRC Letter Transmitting the Supplemental Safety Evaluation Report Related to the License Renewal of PNPS (ADAMS Accession No. ML072140328)

APPENDIX C

PRINCIPAL CONTRIBUTORS

This appendix lists the principal contributors for the development of this safety evaluation report (SER) and their areas of responsibility.

Appendix C: Principal Contributors	
Name	**Responsibility**
R. Auluck	SER Support
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G. Cranston	Management Oversight
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Y. Diaz	SER Support
M. Evans	Management Oversight
E. Forrest	Mechanical Engineering
G. Galletti	Quality Assurance
E. Gettys	SER Support
K. Green	SER Support
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M. Mitchell	Management Oversight
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J. Segala	Management Oversight
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Advance Technologies and Laboratories	Engineering

APPENDIX D

REFERENCES

This appendix lists the references used throughout this safety evaluation report (SER) for review of the license renewal application (LRA) for Pilgrim Nuclear Power Station.

	REFERENCES
Number	Reference
1.	NUREG-1800, Revision 1, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” September 2005.
2.	NUREG-1801, Revision 1, “Generic Aging Lessons Learned (GALL) Report,” September 2005.
3.	NEI 95-10, Revision 6, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule,” September 2005.
4.	Transcript of ACRS Meeting of Plant License Renewal Subcommittee on April 4, 2007 in Rockville, MD. Page 27. (Accession No. ML071090564)

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Perry Buckberg

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8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Division of License Renewal
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

same as above

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

This safety evaluation report (SER) documents the technical review of the Pilgrim Nuclear Power Station (PNPS) license renewal application (LRA) by the United States (US) Nuclear Regulatory Commission (NRC) staff (the staff). By letter dated January 25, 2006, Entergy Nuclear Operations, Inc. (ENO 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." ENO requests renewal of the PNPS operating license (Facility Operating License Number DPR-35) for a period of 20 years beyond the current expiration at midnight June 8, 2012.

PNPS is located approximately 4 miles southeast of Plymouth, Massachusetts. The NRC issued the PNPS construction permit on August 26, 1968, and operating license on September 15, 1972. PNPS is a Mark 1 boiling water reactor design. General Electric supplied the nuclear steam supply system and Bechtel Corporation originally designed and constructed the balance of plants. The PNPS licensed power output is 2028 megawatt thermal with a gross electrical output of approximately 690 megawatt electric.

This SER presents the status of the staff's review of information submitted through September 12, 2007, the cutoff date for consideration in the SER. The staff identified open items that were resolved before the staff made a final determination on the application. SER Section1.5 summarizes these items and their resolution. Section 6.0 provides the staff's final conclusion on the review of the PNPS LRA.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

10 CFR Part 54, license renewal, Pilgrim, scoping and screening, aging management, time-limited aging analysis, safety evaluation report

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